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C. C. ZIMMERMAN, Bus. Mgr. — W. A. D. SHORT, C. E., Editor
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Contributing Editors: A. M. WOLF, C. E. (Concrete); J. G. VAN ZANDT, C. E. (Economics); B. W. MEISEL (Signaling)

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CONTENTS.

Roadmasters' Convention

THE THIRTY-SECOND annual convention of the Roadmaster's Association promises to be the most interesting and instructive besides the largest attended convention yet held. The program is prolific of good things, both in the way of business and of recreation, for both members and their wives. The speakers at the banquet are men of the highest type in their line and also men who are thoroughly conversant with the needs of permanent way and the men in direct charge of it. Everything seems propitious for both an instructive meeting and one of holiday spirit after the business hours.

The Rate Decision

DISCUSSION of the merits and demerits of the recent rate decision of the Interstate Commerce Commission still continues to be widely carried on and again emphasizes the necessity of more rapid work in the valuation appraisals of the railway properties, as mentioned editorially in our last issue. It is hard to see how the administration intended to help the railways if such decisions are going to stand. The scant increase of practically 1.5 per cent granted to the railways of central territory has been of practically no benefit, as even this slight increase was allowed only on certain restricted articles which constitute a small percentage of the tonnage. The heavy tonnage of the railways in this territory is principally lumber, coal and ore, an increase in rates on these commodities would have been of some assistance to the railways and the increased earnings would have allowed them to make much needed improvements in permanent way and structures.

There is one railway in this territory which made a five-year contract some three years ago, to handle in the neighborhood of one million tons of coal per annum. Owing to the increases in wages and costs of supplies this railway has been losing money of late on their tonnage. An increase in rates on this commodity would have allowed this particular railway to have shown a credit balance for handling this tonnage. As it now is the railway will have to continue handling it at a loss. The commodities upon which an increase was allowed will not make much difference in the net revenues.

The Interstate Commerce Commission should consider the case of each railway as soon as the physical valuation is completed and allow increases in rates that will yield a "fair return." If the commission and the railways wait until the appraisals of all the railways are made before deciding on the amount of rate increase allowable it would work a real hardship on some railway companies. The Lehigh Valley has jujst recently finished a physical valuation of their property with their own forces. We do not know whether or not the commission has given consideration to allowing an increase in rates to this railway, which is in the Eastern district, or the territory in which the commission allowed no increase. The New York Central and the New York, New Haven & Hartford had complete appraisals made of their properties some three years ago. Is it going to be necessary to have this work all done over again before the commission will rule as to whether or not they are earning a "fair return" in their investment and the cost of reproduction? It will probably be ascertained that the New Haven company, with all of its recent financial difficulties, is not earning the returns it should if based on the cost of repro-

duction. Therefore it seems only just that something be done either towards accepting the appraisal made by the company in 1912 or to facilitate the appraisal to be made by the Government.

Grade Crossings

IT IS INTERESTING to note that the Public Utilities Commission of Illinois intends carrying on an active campaign to reduce the danger at highway grade crossings throughout the state. The commission will attempt to secure the arrest of all trespassers on the railway permanent way through the coöperation of the railway officials and employees. This is as it should be for a large percentage of personal injury cases are those of trespassers. But with the present railway organizations in this country it is going to be a very great task to secure the arrest of trespassers, much less secure convictions. In England the problem has been very well solved by the appointment of all track, bridge, building, and signal foremen as well as supervisors as police officers. The consequence is: trespassing on the permanent way has been practically eliminated, which means that "hoboing" as known in this country, does not exist there. If the State Commission would have the railway men, whose duties give them charge of the permanent way, appointed police officers it would be a big step towards solving the trespasser problem.

Possibilities of Reverse Signalling

THERE SEEMS to be greater possibilities in the development of reverse signaling or the signaling of track against the normal movement of traffic than has been carried out so far on most of the double and four-track railways. With the modern automatic signal apparatus there is every reason why the tracks of double and four-track railways should have signal installations for handling trains in both directions, in order to get the full benefit of the capacity of the tracks. This could be started in congested districts, first where the density of traffic naturally vacillates at different hours of the day. If the railway has not been equipped with the automatic block signal system it simplifies the installation of the reverse system for, if the traffic, at the time of installation, does not demand reverse signalling, the fittings can be put up at comparatively little additional cost, and the relay points of the control circuits left blank. It would then be a comparatively simple matter when the increase of traffic demanded a constant use of tracks in a reverse direction to install the additional signal mechanicians and circuits. The automatic block system controlling the reverse movements should be laid out along the most approved installations of single track, for in this instance opposing movement protection must be given as well as following movement.

Without reverse signalling on a two-track line with automatic block signals installed throughout for protection and spacing of following movements, the capacity of the tracks, when used for movements against traffic is really decreased because there have been a certain number of telegraph offices and block signal stations eliminated when the automatic block signals, for governing trains in the normal direction of traffic, were first installed. Consequently, with trains running against traffic the system of operation must be reverted to the old type of telegraph block, which in this instance are much longer than the original blocks, on account of stations being eliminated when the automatic were installed, with the consequent delay from spacing trains by the time limit or the entire length of the block. the block.

Track Precautions for Winter

THIS IS the time of year when the summer reconstruction work on track and structures is drawing to a close and thought should be given to getting the track in its final bed to be able to withstand the rigor of the winter months. More care than usual should be taken this year, if it is possible, for nearly all the railroads have been compelled to curtail expenditures on maintenance matters and consequently reconstruction of track with the attendant relaying of rails has been carried on with less vigor this year than for some years past. One large system was recently reported by an expert as having $15,000,000 worth of deferred maintenance of permanent way and equipment. Probably half of this sum would apply to the maintenance of way department, nevertheless this figure is stupendous for one system and is another example of the dire straits our railways are in on account of reduced earnings and increased operation costs.

ROADMASTER'S AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA.

The program of the thirty-second annual convention, Chicago, September 8 to 11, is as follows:

TUESDAY, SEPTEMBER 8.

Morning.

Convention called to order at 10 a. m. by President T. F. Donahoe.

Address of welcome on behalf of the city of Chicago by Hon. Carter H. Harrison, mayor of the city.

Addresses of welcome on behalf of the railroads by Mr. W. G. Bierd, president of the C. & A. R. R., and Mr. R. H. Aishton, vice president of the C. & N. W. Ry.

Address of welcome on behalf of the Track Supply Association by President Walter H. Allen.

Three-minute addresses by the past presidents of the association.

Afternoon.

Reading of committee reports and general discussion.

WEDNESDAY, SEPTEMBER 9.

Morning.

Session at 10 a. m. Reading of committee reports and general discussion.

Afternoon.

Session. Reading of committee reports and general discussion.

Evening.

Trip to White City for visiting ladies, by courtesy of the Track Supply Association.

THURSDAY, SEPTEMBER 10.

Morning.

Session at 10 a. m. Reading committee reports and general discussion.

Afternoon.

Session. Reading of committee reports and general discussion.

Evening.

Theater party for the visiting ladies.

The third annual banquet given by the Track Supply Association in honor of the members and guests of the Roadmasters

and Maintenance of Way Association of America, at the Auditorium Hotel banquet room. Among the speakers will be Mr. A. W. Thompson, vice president of the B. & O. R. R.; Mr. E. F. Wendt, valuation engineer of the Interstate Commerce Commission; Mr. T. F. Donahoe, president of the association, and three other gentlemen of prominence.

FRIDAY, SEPTEMBER 11.

Morning.

Election of officers. Reading of committee reports and general discussion.

CONVENTION PROGRAM OF THE RAILWAY SIGNAL ASSOCIATION.

Secretary Rosenberg has issued the following program of subjects for the annual convention of the Railway Signal Association, to be held at Bluff Point, N. Y., beginning September 22.

Committee I, Signaling Practice—Reports on aspect for instructions to trains to take siding at a non-interlocking switch; requisites for switch indicators and automatic train control. Also additional data on track circuits and treated ties.

Committee II, Mechanical Interlocking—Mechanical Derail Layouts and Switches. (Eight drawings.)

Committee III, Power Interlocking—Specifications for the installation of a vitrified clay conduit system, including drawings; specifications for incandescent electric lamps; the use of thirty volts or less for the control of interlocking apparatus, conclusions 1 to 8, inclusive. Revised drawing 1309.

Committee IV, Automatic Block—Specifications for R. S. A. cell caustic soda primary battery and specifications for direct current vibrating highway crossing alarm. Three (3) drawings showing circuits for automatic block systems submitted as information.

Committee V, Manual Block—Rules governing signal supervisors and rules governing maintenance of block signals.

Committee VI, Standard Designs, Signal Symbols and Nomenclature—Presenting twenty drawings of various apparatus shown in detail and assembly. Also six exhibits as information. Report on signal symbols and nomenclature.

Committee VII, Subjects and Definitions—Definitions for twelve (12) words.

Committee VIII, Electric Railways and A. C. Signaling—Specifications for transformer oil; specifications for petrolatum for use in impedance bonds; specifications for a. c. electric generators, and specifications for overhead crossings of electric light and power lines. Also data of systems using a. c. in railway signaling submitted as information.

Committee IX, Wires and Cables—Changes in existing specifications for galvanized steel signal wire. Specifications for galvanized messenger wire, also recommended sags for messenger wire of various sizes and strength; specifications for rubber insulated tape and specifications for friction tape.

Committee X, Storage Battery and Charging Equipment—Specifications for electrolyte for lead type storage battery; specifications for nickel, iron alkaline storage battery and specifications for concrete storage battery box. Also eight (8) drawings.

Special Committee, Method of Recording Signal Performance.—Five (5) forms for recording interruptions to traffic by signals.

Special Committee, Signaling Requirements of Electric Railways—Reports showing signal aspects and rules for same as adopted by the American Electric Association submitted as information.

Special Committee, Lighting Protections—Specifications and requisites for air gap lightning arresters; specifications and requisites for vacuum gap lightning arresters and specifications and requisites for choke coils for use with lightning arresters.

Twenty Years Ago This Month

(From the Files.)

J. A. L. Waddell has been appointed consulting engineer of the Northwestern Elevated of Chicago.

John E. Early has resigned as chief engineer of the Mexico, Cuernavaca & Pacific and that office has been abolished.

W. D. Tyler, president and general manager of the Washington & Columbia River, was on Aug. 25 appointed receiver of that road.

J. Burlingett, assistant general superintendent of the Chicago Great Western, has removed his headquarters from Oelwein, Iowa, to St. Paul, Minn.

J. H. Foster has been appointed superintendent of the James River division of the Chicago, Milwaukee & St. Paul, with headquarters at Aberdeen, S. D.

C. M. Bolton, chief engineer of the eastern system of the Southern railway, has had his jurisdiction extended over the western system. His headquarters will remain at Washington, D. C.

J. M. Bair has resigned as division superintendent of the Chicago, Milwaukee & St. Paul at Chicago and has been appointed superintendent of the Breckenridge division of the Great Northern, with headquarters at Willmar, Minn., taking effect Sept. 1.

M. S. McCay, who resigned as superintendent of the San Luis division of the Mexican Central in June, has been appointed general superintendent of the Mexico, Cuernavaca & Pacific, in charge of operating maintenance of way and material department.

J. B. Cable, superintendent of the Kansas City division of the Chicago, Milwaukee & St. Paul, has been appointed superintendent of the Chicago & Milwaukee, Chicago & Council Bluffs and Chicago & Evanston divisions of that road, with headquarters at Chicago, in place of J. M. Bair, resigned.

D. W. Linn, chief engineer of the Southern railway (western system) at Knoxville, Tenn., has been appointed general roadmaster of the western system in charge of maintenance of roadway and structures, with office at Knoxville, Tenn. He will be assisted by a roadmaster for each division, located at the following points: Knoxville, Tenn., Birmingham, Ala., Atlanta, Ga. The office of engineer maintenance of way on all divisions is abolished. The following appointments are announced by Mr. Linn: J. E. Plant, roadmaster fourth division; J. S. Leonard, roadmaster fifth division; J. A. Davenport, roadmaster sixth division.

The twelfth convention of the Roadmasters' Association of America was held in New York on the 11th, 12th and 13th insts.

The Citizens' committee on track elevation in Chicago has received a report from General Charles Fitz Simons in regard to the progress of the work which was inaugurated on Sept. 1 by the Lake Shore and Rock Island under the charge of L. H. Clarke, chief engineer.

W. S. Lincoln has resigned as chief engineer of the Wabash.

E. C. Rice has been appointed chief engineer of the Wabash, with headquarters at St. Louis, Mo.

W. S. Moore has been appointed engineer maintenance of way of the Michigan division of the C. C. C. & St. L.

W. H. Jennings has been appointed chief engineer of the new Columbus, Hocking Valley & Athens road, with headquarters at Columbus, Ohio.

L. C. Weir, western manager of the Adams Express Company, has been chosen president of that company to succeed Mr. Henry Safford, resigned.

Willard A. Smith has been appointed by the trustees of the Field Columbian Museum honorary curator of the division of transportation of the department of industrial arts.

Little River Bridge, L. & A. Ry.

The Louisville & Arkansas Ry. crosses Little River in Catahoula Parish, La., about 10 miles from Jonesville. Late in 1913 a new single track bridge was completed at this point. It consists of three through rivetted truss spans 117 ft. 6 in. long, supported on concrete piers resting on piles, the center span being a vertical lift span.

The track is level and tangent over the bridge and approaches.

Fig. 1. Little River Bridge, L. & A. Ry.—Lift Span Down.

Short pile trestles were necessary next to the bridge at each end. The trusses of the spans are 17 ft. 3 in. center to center; the trusses are 1 ft. 2⅞ in. back to back, which gives a lateral clearance of 16 ft. ⅛ in. The floor stringers are on 7 ft. centers, 3½ ft. from center line of bridge, the distance from center of stringers to center of trusses being 5 ft. 1½ in. The height of spans is 33 ft. center to center of chords. The bottom of portal bracing is 10 ft. below center of top chord, and the track is 5 ft. above center of lower chord, giving about 17 ft. vertical clearance where the horizontal clearance is 16 ft., and an additional vertical clearance of 5 ft. to the lower chord of the portal bracing.

The lift span gives a clear opening of 100 ft. High water elevation is +59.23, low water +18.01, and track level +69.00.

Design.

The three spans are duplicates, except that the two end spans have towers connected to them, and the central span has additional members and struts to provide connections for lifting it. The central span is arranged to lift between the towers on the two adjacent spans to a height of 45 ft. clear above high water, which is sufficient to clear the vessels which navigate on the river.

It will be seen that the layout for the small river crossing is most adaptable, as it places one pier on each side of the channel, spanning practically the entire river at low water.

Live Load.—The bridge was designed for De Pontibus class Q loadings (shown herewith), which correspond quite closely to Cooper's E-50. Impact was added according to the formula

$$I = \frac{400}{L + 500}$$

Both the trusses and floor system were designed for this loading. Lateral or wind loads were provided for due to 450 lbs. per lineal foot on the loaded chord and 150 lbs. per foot on the unloaded chord.

Dead Load.—The floor system, that is the ties and rails, were figured at 400 lbs. per lineal foot.

Stresses.—The shoes under the spans on top of the piers were proportioned to load the concrete at 350 lbs. per square inch. The total normal load on piles was limited to 30 tons each, and the maximum load, including that added by extreme wind, would be 32 or at most 33 tons per pile.

The structural steel was designed for a stress of 16,000 lbs. per square inch tension. Top chords, $18{,}000 - 70\frac{l}{r}$. Inclined end posts, $18{,}000 - 80\frac{l}{r}$. All other compression members, $16{,}000 - 60\frac{l}{r}$.

Concrete was figured for a load of 350 lbs. per square inch compression.

Scarf Joint.—A detail is given in figure 4 of the scarf joints which were put in 30 ft. from the end of the lift span, on both sides. Each of these joints provides for an expansion and contraction of 2 in. The rail is held laterally by 3x3x½ in. angles bolted to a base plate 10⅞x⅞x3 ft. 4 in., the angles resting snugly against the sides of the rail base; ⅝ in. flats are bolted to the inside of angles, fitting snugly down on top of the rail base, thus holding rail vertically and horizontally.

Materials.

The material is medium steel and the shop work was of the best. Rivet holes were sub-punched and reamed with parts assembled. The trusses were assembled at shop, and all field holes reamed. Rigid double plane portals are provided at each end. The steel work was painted with three coats of paint.

The concrete was a 1:3:5 mixture with gravel as the coarse aggregate.

Substructure.

Borings were made to show the nature of the soil strata, and on the north bank, at pier number 1, the test boring showed, starting at elevation 47.5, black earth, brown clay, stiff blue clay, and at

about elevation 7.5, hard clay. The boring was not carried further, as this material was firm enough to support piles.

Borings for center pier, No. 2, were started at about elevation 15 and carried down through mud, quicksand, gravel, sand, and mud, to blue shale, about 60 ft., to an elevation of -45 to foundation strata. Borings at pier 3 showed good bottom at about same depth as pier 2, and pier 4 showed good bottom at about the same depth as pier 1.

Piles were deemed necessary for the end piers due to the possibility of landslides which occur along the banks, and which might in time expose a shallow foundation. Piles about 50 ft. long were required for center piers, and even then the center piers are nearly 50 ft. high.

Forty-four piles were used in the end piers, supporting 34x15 ft. rectangular plain concrete footings 10 ft. thick. The footings for center piers are 34x16 ft. rectangular, and also 10 ft. deep, supported on 55 piles each.

The pier bodies have two circular segments, one at each side, connected by a rectangular center section about 4 or 6 ft. wide. The circular portions have a taper from 6 ft. to 9 ft. diameter in the end piers, and from 8 ft. to 12 ft. in the center piers. The copings, as shown in the plan, extend across the top of pier with a constant width equal to the diameter of circular sections, thus projecting beyond the face of rectangular connecting portion about 2 feet.

These circular faced piers are a modification of the cylindrical piers embodying two cylinders fastened together at the top by a reinforced concrete beam. In this case the rectangular portion is carried down to footings. The illustrations show the attractive appearance of the piers, and also indicate the saving in concrete due to using this design in place of a rectangular pier.

The footings are all located low enough so that their tops will probably never be exposed, the center pier having tops of footings about 6 ft. below low water, while the footings for end piers are 16 ft. below the ground surface on the north side, and 22 ft. below ground surface on the south side. The possibility of slides made it advisable to place the end pier footings this far below the ground surface.

Superstructure.

The trusses are of the Pratt type, rivetted through trusses, with an extra diagonal or counter in center span, which operates as a tension member when the other diagonal in the same panel is rendered inoperative when subjected to compression.

The length of each span is 117 ft. 11 in., though the distances from center to center of piers is not the same, being 118 ft. in the end spaces and 122 ft. 1 in. for the center span. The use of the same length trusses was possible because the channel was practically in the center of the stream, and nothing prevented the piers being located in the positions as shown. Besides reducing the work of structural design to the working out of only one span, this design gave a symmetry which adds considerably to the appearance of the structure. And the shop work was also considered simplified by this arrangement.

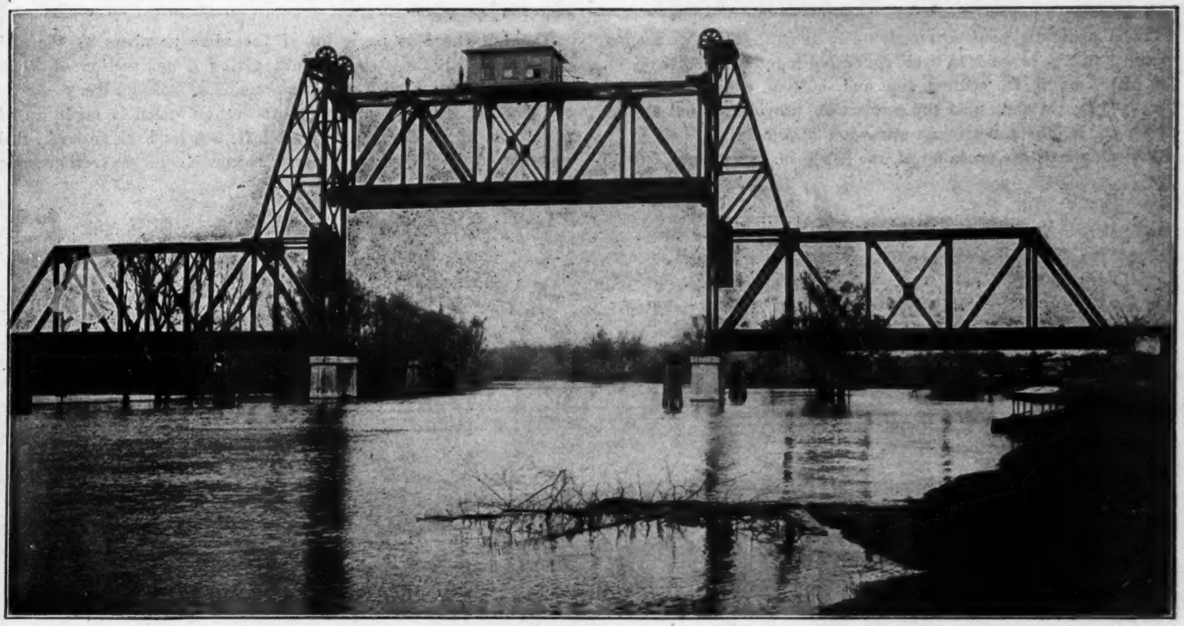


Fig. 2. Little River Bridge, L. & A. Ry.—Lift Span Raised.

The truss shown herewith, with five 23 ft. 7 in. panels, is the design followed in each of the spans. The maximum stress is in the end chord, where a compression of 403,000 lbs. is provided for. The elevation shows the make-up of all members in a way which makes this formation exceptionally easy to pick off of the plan.

The lower truss bracing consists of diagonals from each panel point, each made up of two 3½x3x⅜ in. angles with the legs upward. One of these diagonals in each panel is a continuous member from panel point to panel point, while the opposite member is cut into two parts at the intersection of the diagonals, at which point the diagonals are rivetted to a ⅜ in. joint plate. Two transverse members are provided connecting the diagonals, to provide for train thrust.

The stringers are girder sections 4 ft. 2¼ in. back to back of angles, web 50 by ⅜ in., angles 6x6x½ in., with vertical angle stiffeners at the third points, having a span of 23 ft. 7 in. center to center of floor beams. The stringers are rivetted to floor beams by means of two 4x⅜ in. angles.

Floor beams are girder sections 5 ft. 2¼ in. deep, made up of ⅜ in. web plate and 6x6x⅜ in. angles, connected to transverse trusses by 5x3½x⅜ in. angles. The stringers are rivetted at points 3 ft. 6 in. from center of beam, stringers being 1 ft. shallower and located 6 in. below top and 6 in. above bottom of beam. This brings the beams up 4½ in. above bottom of ties in the bridge floor, but makes the chords the low steel in the structure, thus giving maximum clearance.

Trusses are braced on top by diagonals between panel points, each consisting of one 4x2½x⅜ in. angles, except in lift span where the diagonals in center panel are 4x3x⅜ in. angles. Floor

beams are braced by four diagonals to each panel, each consisting of a 3½x3½x⅜ in. angle.

By providing the Pratt truss with the counter in center panel, it will be remembered, all diagonals except the end diagonals become tension members. The vertical end posts are tension members, while intermediate posts are compression members.

Two 15 lb. channels spaced 1 ft. 2¾ in. back to back, tied together with 9x15x⅜ in. tie plates, spaced 3 ft. centers top and bottom, with special 14x15x⅜ in. cover plates near connections, provide a net section of 15 ft. 6 sq. in. for the tension diagonals in intermediate panels, maximum stress being 250,500 lbs.

Center panel diagonals are made up of four 3½x3x⅜ in. angles, spaced 1 ft. 2¾ in. back to back, connected together by 9x15x⅜ in. tie plates on 3 ft. centers top and bottom with one special 14x15x⅜ in. tie plate near top connection, providing a net section of 6.2 sq. in. for a maximum stress of 99,000 lbs.

End diagonals are made up of one 23x½ in. cover plate, two 15 in. 33 lb. channels, and two 4x¾ in. flats, giving a net section of 37.3 sq. in. for a compression of 403,000 lbs.

End verticals are made up of four 6x4x$\frac{7}{16}$ in. angles spaced 1 ft. 2¾ in. back to back, tied together with 9x15x⅜ in. tie plates on 3 ft. centers, top and bottom, with special tie plates near connections. The net section is 13.22 sq. in., and the maximum tension 235,500 lbs.

Intermediate verticals are made up of two 12 in. 25 lb. channels spaced 1 ft. 2¾ in. back to back, with 2½x3 in. lacing bars. The net section is 14.7 sq. in. gross, and the maximum compression 109,000 lbs.

The top chord is made up of the same members as the end diagonals, with the flats left off, giving a net section of 31.30 sq. in. gross, for a maximum compression of 359,000 lbs.

The lower chord in all except the center panel is made up of two 15 in. 33 lb. channels, spaced 1 ft. 2⅞ in. back to back, tied together by long ⅜ in. plates on bottom under connections, and

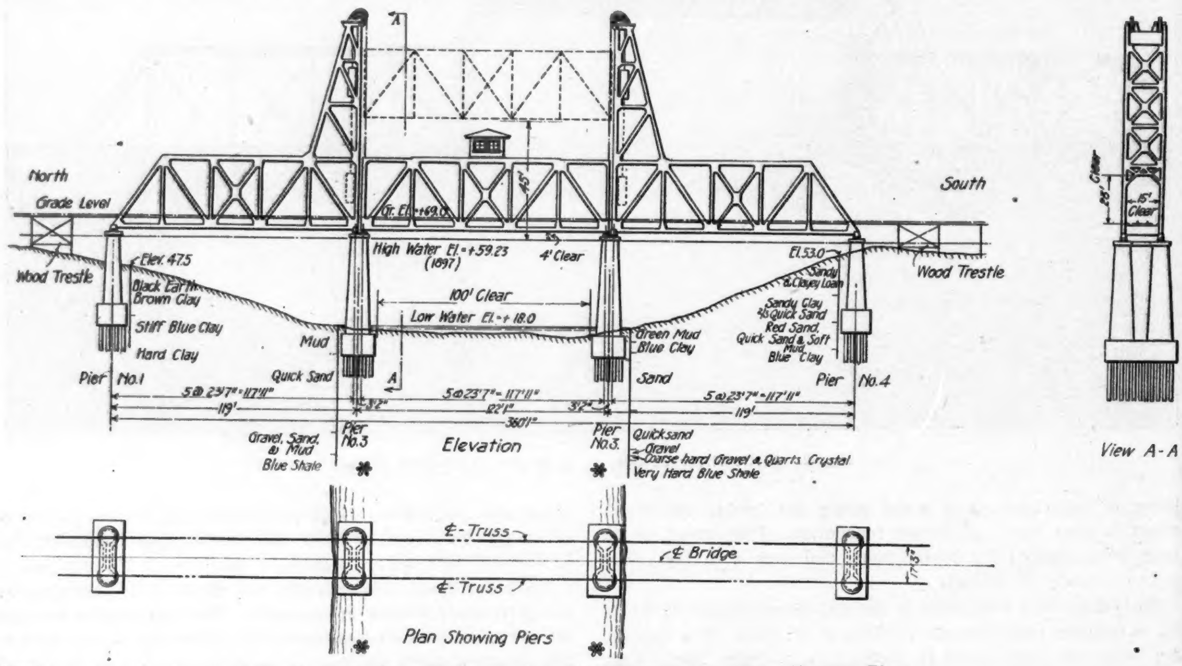


Fig. 3. Little River Bridge, L. & A. Ry.—Elevation and Plan, Showing Piers.

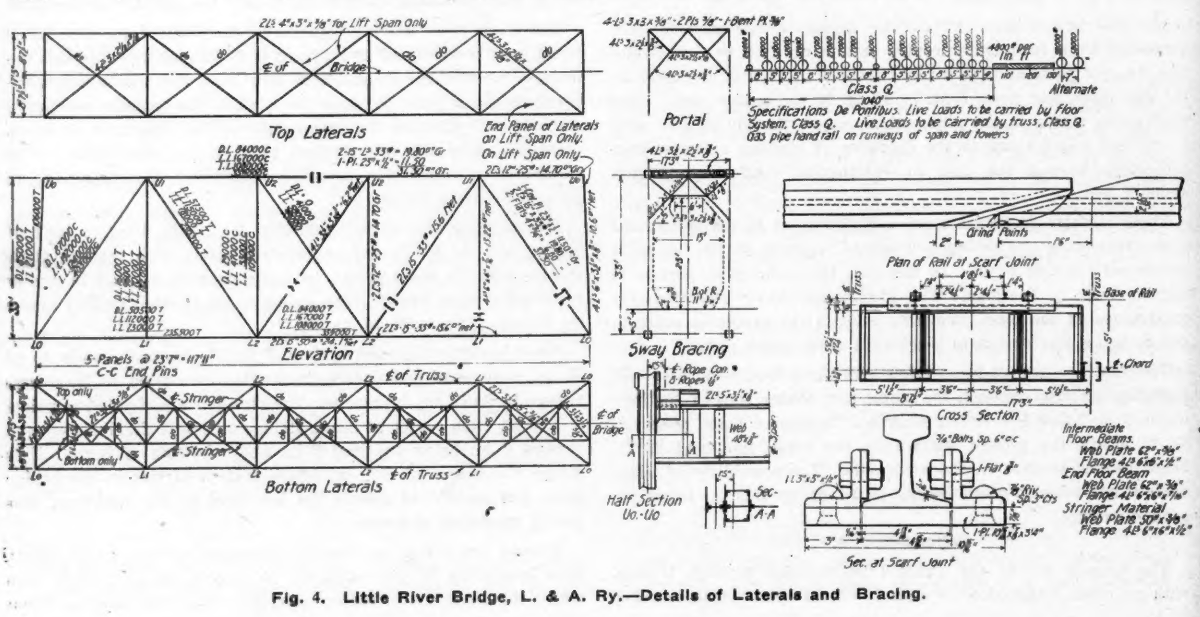


Fig. 4. Little River Bridge, L. & A. Ry.—Details of Laterals and Bracing.

intermediate ⅜ in. plates top and bottom. The net section is 15.6 sq. in., and the maximum tension 235,500 lbs. The channels in center panel are 15 in. 50 lbs., giving a net section of 24.1 sq. in. for a maximum tension of 359,000 lbs.

Lift Span.

The lifting span is suspended by eight wire ropes at each corner, which pass up and over sheaves at the tops of the towers and are connected to two counterweights of concrete and steel balancing spans. The operating machinery, which is carried on top of the lifting span at the center, consists of four spirally grooved

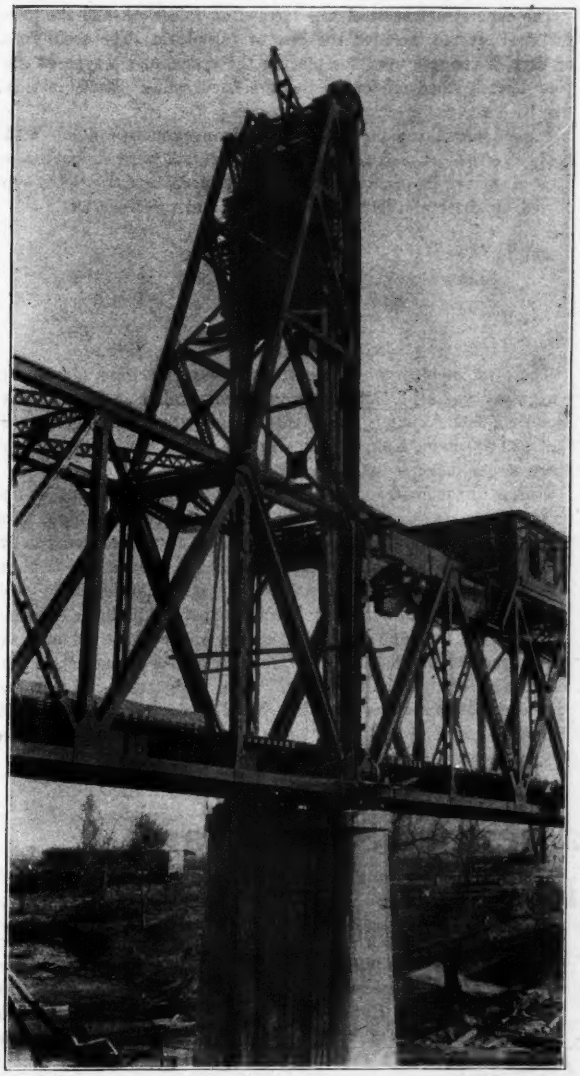


Fig. 5. Little River Bridge, L. & A. Ry.—Method Used in Erecting Counterweights.

drums actuated through trains of gears by a gasoline engine. Each drum controls two operating ropes. The one from the top of the drum leads over a sheave at the corner of the span, thence downward, and is fastened near the bottom of the tower, and the one from the bottom of the drum leads under the sheave at the corner of the span, thence upward, and is fastened at the top of the tower. All four drums are similarly connected, and when they are revolved in one direction, the ropes leading to the tops of the towers are wound on, and those connected to the bottoms of the towers are payed off, thus raising the span by the lifting force exerted on the four corner sheaves. Reversal of direction of revolution of the drums lowers the span. Brakes with automatic

Fig. 6. Little River Bridge, L. & A. Ry.—One of the Winding Drum Shafts.

stops control the movement of the span, and a hand brake is provided for manual control. The span may also be operated by hand through a capstan for emergency conditions. The ends of the operating ropes are attached to turn buckle adjustments so that any stretch which occurs may be taken up and the ropes kept taut. The span is thus held definitely level during its movement up and down, and is under absolute control of the operator.

This type of structure requires for the movable span piers of no greater size than are used for the simple spans. A single wide channel is provided, and as no draw protection or other construction in the river is required, boats can pass through at an angle. The span need be lifted only high enough to clear the vessel passing, and can, therefore, be operated with dispatch.

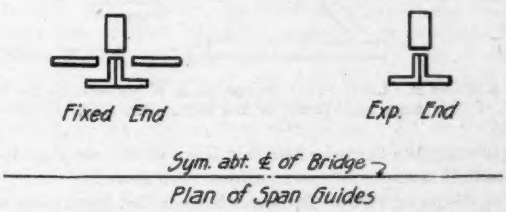


Fig. 7. Little River Bridge, L. & A. Ry.—Arrangement of Span Guides.

At one end the lifting span is held in position during motion by suitable roller guides engaging on tracks on the tower columns, maintaining a position both laterally and longitudinally, and at the opposite end of the span the guides maintain only a lateral position, so allowing for the expansion and contraction of the span.

Fig. 6 shows one of the winding drum shafts. The drum is on the left end, the jaw connecting it to the gear train on the right. In the center is an automatic device for stopping the bridge at both limits of operation. This device consists of a nut traveling on a thread between two nuts locked onto the shaft. The latter are adjustable so that the limits may be varied. A projection on the traveling nut engages a similar one on one of the fixed nuts when

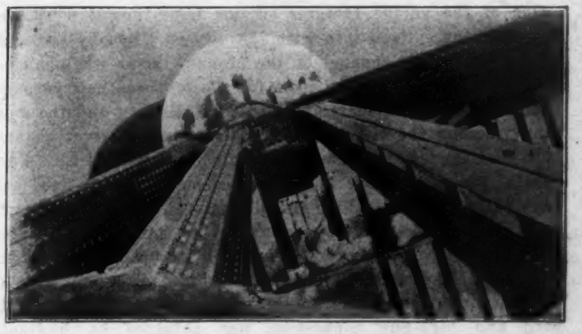


Fig. 9. Little River Bridge, L. & A. Ry.—View From Top Chord Showing One of Span Guides in Place.

the span is near the limit of operation, and the traveling nut is thus turned, operating a lever which throws out the clutch. The outside casing of this apparatus (removed in the illustration) holds the nut from turning until the limit is reached. This device works very satisfactorily in service.

Fig. 7 shows one of the span guides for the fixed end of the lift span. It contains three rollers, which travel against a vertical track, one preventing lateral travel (in connection with a similar guide on the opposite truss), the other two preventing longitudinal travel.

The diagram, Figure 8 A and B, illustrates the guides for the fixed ends, and also the guide for the expansion end. In the latter, Figure 5 B, two rollers are omitted, thus allowing for longitudinal travel to take care of expansion. The single roller (in connection with a similar roller on opposite truss) prevents lateral movement.

Fig. 9 shows a view looking down from top chord, and shows one of the guides for fixed end of span in position on bottom chord.

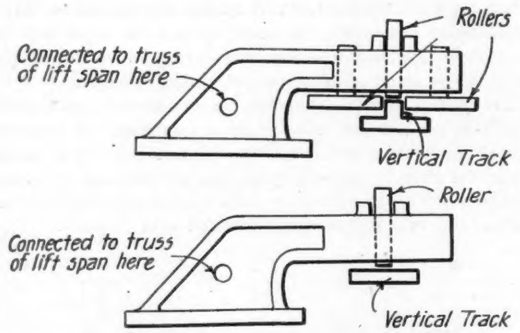


Fig. 8 A and B. Little River Bridge, L. & A. Ry.—Guide for Fixed End, and Guide for the Expansion End.

The casting with the large hole in it is one of the centering devices. These hold the span in exact position when down.

The design of vertical lift spans is controlled by patents owned by Waddell & Harrington.

Construction.

The piers were constructed by sinking an open-bottom wooden crib to the necessary depth, and by driving and jetting therein the piles for foundation support. The material between piles was then cleaned out and the concrete deposited under water through a tremie sufficient to make a concrete bottom to the timber crib. After the concrete had sufficient time to set the water was pumped out, the piles cut off at the proper elevation, and the remainder of the concrete placed in the dry. Moulds of smoothly dressed planks were built for the construction of the pier shafts. The concrete was mixed by a rotary mixer. The concrete was carried from the mixer to the pier in a bucket handled by the same derrick which had been used to do the excavating. I believe that it is of sufficient interest to add that the same derrick was used to operate a clam-shell to do the backfilling, with the excavated material, around the piers after the moulds had been removed.

The superstructure steel was erected on falsework and the price for steel erected included the cost of falsework. The usual form of derrick car was used for placing the spans, and a type of gin-pole derrick stood on top of the two fixed spans. Each, in turn, was used for the erection of the towers.

Fig. 5 shows the method of supporting counterweights while being erected. The forms for counterweights were supported on four piles, two at each end of heavy form timbers, the piles supported on the piers between the trusses and the track ties.

Cost.

The total cost of the bridge was as follows:

Substructure	$ 39,000
Superstructure	63,000
Total (including engineering)	$102,000

The total cost for providing towers, counterweights, machinery, wire ropes, and all details affecting the movability of the span, was about $29,000. That is to say this bridge with its lifting features cost $29,000 more than the same bridge would have cost with the three simple, fixed spans.

Owing to the inaccessibility of the site, and the difficulties due to the rainy season, the costs of doing work were very high. For instance, the structural metal in the spans cost 3.243 cents delivered, and cost 1.09 cents to erect. The concrete shafts, or piers, cost $16.00, and the bases of the piers cost $23.00 per cubic yard.

The superstructure was manufactured by McClintic-Marshall Construction Co., and the substructure was constructed and the superstructure erected by the Union Bridge & Construction Co., which also erected the steel work. The bridge was designed and the construction supervised by Waddell & Harrington, E. E. Howard, associate engineer, being in charge. We are indebted to Mr. Howard for information and plans used herein.

New York Central Passenger Station and Yards, Utica, N. Y.

The Utica station of the New York Central was opened on May 24 last and is an integral part of the extensive improvement work that this company has been carrying on in Utica for several years, which will represent an approximate investment of $6,000,000 when completed.

One of the unique features of this improvement work was an agreement entered into with the city of Utica by the company whereby the channel of the Mohawk river was changed, in order to give additional room for the proposed new yardage. There was an agreement made between the city and the company whereby the city was to construct a new river channel 2,000 feet north of the company's main lines and the New York Central was to purchase the excavated material at a fixed unit price to be used in refilling the old channel. In order to carry out this agreement it was necessary to construct an intercepting sewer of large capacity, which was carried under the passenger and freight yards for a distance of a mile east of the station to the river. A great deal of the material for the yard and high-line connection was obtained by hydraulic dredging.

The West Shore, the Ontario and the Adirondack divisions use this station and yards in addition to main line New York Central trains running between Albany and Buffalo. There was formerly a single track connection between the main line and West Shore at Haber, which made it necessary for freight trains to pass over a heavy grade and to drag through short length crossovers in the two passenger tracks, which, at this point, are to the south of the West Shore side of the first track main line. To obviate this a double track high-line connection has been built, which leaves the West Shore just west of Harbor, crosses the main line overhead and swings parallel to the main line east of the main freight yard. The maximum grade of the new high-line connection is 0.25 per cent compensated. Track 4 is diverted to the north east of the high line and is then located north of the entire yard proper and engine terminal. The relocation of track 3 separates it from tracks 1 and 2 and places it in a gradient that is in favor of traffic moving toward the yard. Tracks 1 and 2 are diverted to the south of yard layout and are placed on a separate new embankment for the greater portion of their new location.

The entire yard layout has not as yet been completed but will gradually be added to as the exigencies of the traffic

demand it. The final development as at present planned contemplates nine yards with the following capacities:

	Tracks.	Capacity.
Eastbound tonnage yard	20	2,200 cars
Westbound tonnage yard	20	2,200 cars
Eastbound local freight yard	19	1,000 cars
Westbound local freight yard	8	640 cars
Repair yards		380 cars
Freight house and train track storage yard		300 cars
Coal storage yard		300 cars
Coach yard		78 coaches
Caboose yard		90 coaches
Total capacity		7,188 cars

The tracks in the main yard are laid on 12 ft. centers with

Corner of Lobby, New Passenger Station, New York Central, Utica, N. Y., Showing Vermont Marble Columns.

a 16 ft. space in the middle of the tonnage yards and between adjacent yards, for piling material, rubbish, etc. An 18 ft. to 20 ft. spacing is used along ladder tracks, leads and thoroughfares. The tracks in the repair yards are spaced alternately 16 and 20 ft., with two adjacent ladders through the centers of the yard which divided it completely. No. 8 frogs on No. 7 ladders are used in the principal yards and No. 10 are the sharpest used on running tracks and main line connections. Main line tracks are laid with 105 lb. rail and yard tracks with 80 lb. relaying rail. Creosoted ties and gravel or cinder ballast are used.

The engine house consists of 30 stalls built on a 70-stall circle with provision for the addition of the same capacity in a separate house adjacent to the present one. The depth of 25 of the stalls is 100 ft., and of five, 125 ft. Three drop pits are provided in the long stalls, making it possible to remove any wheel from any engine using the house. A 7-ton electric hoist handles the wheels from these drop pits. The house is a brick structure on concrete footings, similar in type to the generally adopted New York Central standard. The engine terminal also includes a machine shop, power house, fan house, two double track ash pits 200 ft. long, two inspection pits 80 ft. long, a gravity coal trestle, sand house, two 50,000 gal. wooden storage tanks and four penstocks.

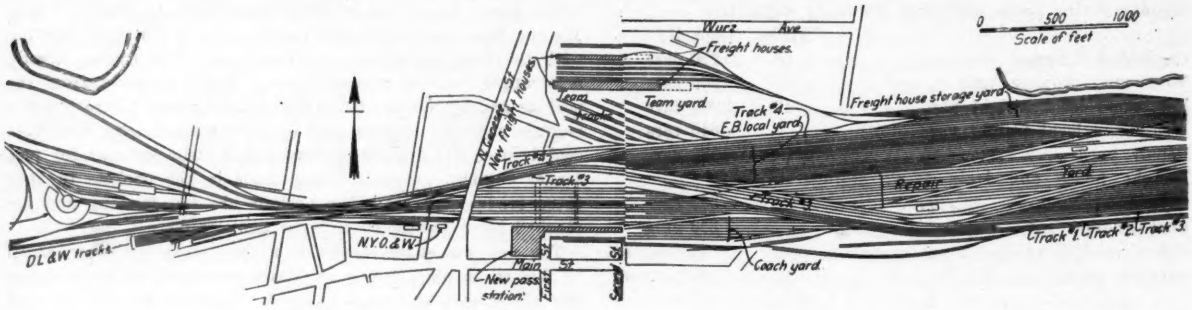
The power house is a brick building 75 ft. by 89 ft. in size. The machine shop is located in an annex building connecting with the long stalls over the drop pits. The coaling trestle is arranged to coal engines on two tracks directly from the pockets and by means of a bridge reaching over to track No. 4 engines can also receive coal on that main track. Clearfield coal is used for freight engines and Pittsburgh coal for passenger engines, provision being made in the pockets to keep these grades separate. The pockets are 160 ft. long and are reached by a trestle on a 5 per cent grade.

The new passenger station is a three-story building 192 ft. by 204 ft. in plan, facing on Main street and on First street, one block east of Genesee street. First street ends at the tracks and provides an entrance to the trucking space alongside the baggage and express building, which extends from the passenger station east to Second street. The front of the station is set back from the street line 18 ft. There are two main entrances on the front covered by heavy marquises. Auxiliary entrances are also provided on both sides of the building. Structurally the station has a steel frame with Bedford stone facing up to the first office floor and grayish rough textured brick for the remaining height. Limestone trim is used throughout. Architecturally the building is of the Tuscan order with only enough ornamentation to relieve the severity of the lines. The first story supports a colonnade of Tuscan columns, between which are placed the window openings for the second and third stories. The colonade is surmounted on the Main street side by a clock 6 ft. 6 in. in diameter supported on either side by cut stone eagles.

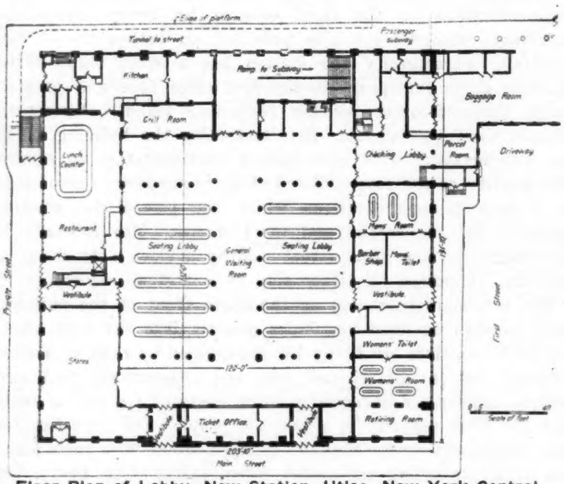
The two main entrances on the south front of the building open through enclosed vestibules directly into the main waiting room, which is 120 ft. by 132 ft., divided by rows of marble columns into a central and two end passageways and two seating lobbies. Each seating lobby contains six double seats and the total capacity is about 400 people. All facilities for handling passenger business are grouped around this main waiting room, including the ticket office, information booth, the women's rooms, barber shop, men's rooms, parcel room and baggage check room, news stand, grill room, restaurant and lunch room. The floors in the main waiting room, men's rooms and restaurant are of terrazo, in the vestibules and ramp leading to the subway of paving tile, in the women's rooms of cork tile, and in the grill room of quarry tile. Vermont marble of soft gray and green veining has been used throughout for wall facing and columns. The vaulted ceiling over the main aisles and the paneled ceiling over the seating lobbies are tinted with a grayish green shade to harmonize with the marble, the relief ornamentation being picked out in dull Roman gold. The woodwork is of oak throughout. The building is heated by steam furnished by three 150 h. p. boilers, located under the baggage house.

The passenger subway is 30 ft. 5 in. wide and 8 ft. high with a center row of columns supporting the roof. The walls are of concrete founded on piles and faced with hard burned face brick. The roof consists of concrete slabs under the platforms and I-beams supporting transverse concrete slabs under the tracks. The ceilings under the solid slabs are of sheet steel painted white. The subway is provided with seats along both walls where passengers can wait until trains are called, and if desirable, two rows can be added between the centers columns. Heat is supplied by direct radiation under these seats. The electric lights are suspended from wall brackets.

The track layout at the passenger station includes 12 station tracks served by six platforms, 20 ft. wide and with a maximum mum length of 1,200 ft. Two through tracks for fast freight and passenger trains which do not stop at Utica are carried through the middle of the layout and are not adjacent to any platforms. The platforms are covered with canopies, 600 ft. long, with provision for extension over the full length of the



Plan of Utica Coach Yard and New Station, West End of Yard, New York Central.

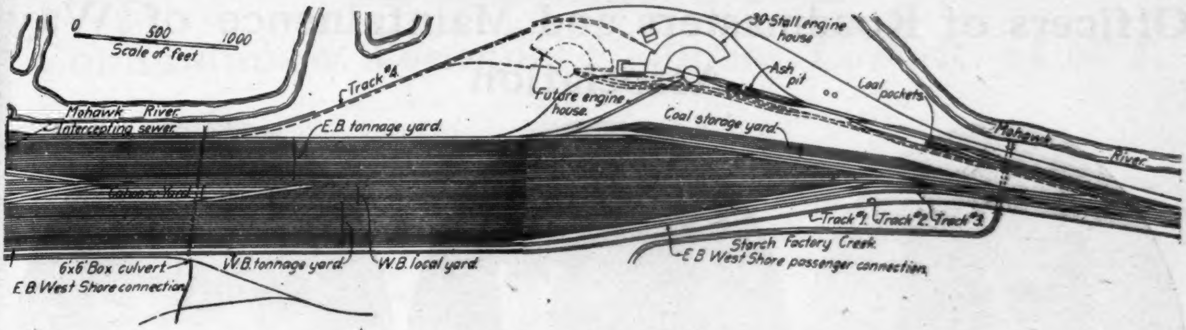


Floor Plan of Lobby, New Station, Utica, New York Central.

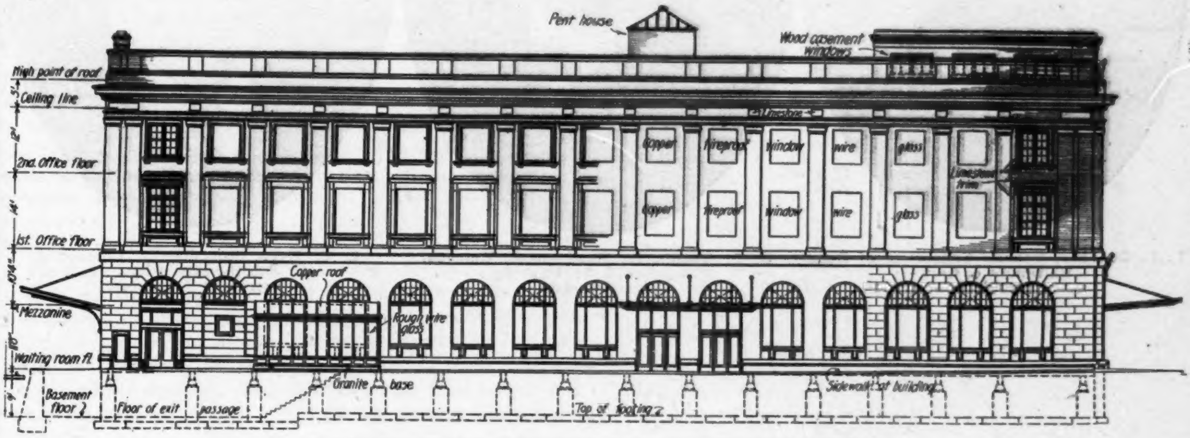
platforms. Each platform is reached by two stairways from the passenger subway below and by an elevator from the baggage subway.

This entire improvement work was carried out under the direction of the engineering department of the New York Central & Hudson River, G. W. Kittredge, chief engineer; C. J. Parker, principal assistant engineer; J. W. Pfau, engineer of construction, exterior zone; E. B. Menuez, district engineer; B. C. Martin and G. F. Chism, resident engineers, and R. T. Horton, assistant district engineer, had resident charge of the work at various times. James H. Dawes (New York State Dredging Corporation), Philadelphia, had the contract for all grading work on the general improvement. The high fill under the high-line connection was let to the Walsh-Kahl Construction Company, Davenport, Iowa. Henry R. Beebe, Utica, had the contract for the construction of subways, platforms, canopies, temporary passenger stations and numerous details. The passenger station was designed by Stem & Fellheimer, New York, and was built under contract by J. Henry Miller, Inc., Baltimore, Md. The freight houses were built by Mosier &

Elevation, Front View, New Passenger Station, Utica, Showing Main Entrance.



East End of Yard, Utica, N. Y., New York Central & Hudson River R. R.



Elevation, Side View, New Passenger Station, Utica, N. Y.

Summers, Buffalo, N. Y., and the engine house by James Stewart & Company, New York. All tracks were laid with company forces.

FIRE FIGHTING ON THE B. & O.

By virtue of a circular issued by the Baltimore & Ohio to its employees, the men working for that company are to be constituted into a vast organization of fire fighters, ready for emergency service in protecting the property of the public and that of the railroad against destruction by fire.

Employees in train service and others whose duties require them to travel over the property are urged by the management to maintain a constant vigil against fire, either on the property of the railroad's neighbors or along its own right of way. Suggestions concerning precautions against fires are requested of the employees.

In the event that fires be discovered by engineers, conductors or other employees in train service, they are pre-emptorily authorized by the company to lend assistance in extinguishing the blaze; but the regulation requires that in such emergency any delay occasioned by assisting in putting out a fire must be reported at the first telegraph station.

While the regulation concerning the suppression of fires has in view primarily the protection of railroad property, the Baltimore & Ohio urges its men to take a broad interest in the communities in which they reside, so that at all times they may render assistance of direct benefit to society. In the cities and towns, division points and terminals the railroad has provided fire-fighting apparatus for the use of employees in emergency cases, and to increase the efficiency of such protection the men are drilled, in order that they keep themselves on the alert. Numerous instances have been reported of railroading forces preventing serious fire destruction.

The campaign waged by the Baltimore & Ohio against fire losses extends beyond the employees to the mechanical operations of the property. Locomotive stacks have been equipped with spark nettings to prevent particles of fire from being scattered along the right of way or on adjoining property, and the fire grates in the engines are so designed that hot coals are not dropped along the tracks. In the ends of sidings, where locomotives usually stand when waiting to pass trains, wooden ties have been replaced by steel ties, for the prevention of fire.

STRUCTURES.

The Chicago & Alton has awarded a contract to the Ogle Construction Co. for a 150-ton coaling station at Venice, Ill., to replace the old conveyor recently burned.

The Chicago & North Western has awarded a contract for a bridge on its main line over the Milwaukee river near Milwaukee, to the Cleary-White Construction Company, Chicago.

The Chicago, Indianapolis & Louisville has awarded a contract to the Ogle Construction Co. for a 200-ton coaling plant at New Albany, Ind.

The Cleveland, Cincinati, Chicago & St. Louis will build a new terminal at Dayton, Ohio, at an estimated expenditure of $200,000, according to report.

The Delaware, Lackawanna & Western terminal at Buffalo, N. Y., has been held up, two temporary injunctions having been granted against the terminal commission.

The Lackawanna County Commissioners, the Scranton Ry. Co., Delaware & Hudson, Erie, and New York, Ontario & Western are planning construction of a viaduct at Simpson, Pa., to cost $68,000.

The city council of Scranton, Pa., has passed ordinances approving plans of Delaware, Lackawanna & Western for construction of three viaducts and one foot bridge to cost $112,000.

Officers of Roadmasters and Maintainence of Way Association

T. F. Donahoe, General Supervisor of Road, Baltimore & Ohio, President.

B. C. Dougherty, Roadmaster, Chicago, Milwaukee & St. Paul Ry., Vice-President.

L. C. Ryan, Roadmaster, Chicago & Northwestern Ry., Secretary-Treasurer.

Officers of the Track Supply Association

W. H. Allen, Pennsylvania Steel Co., President.

E. M. Fisher, Fairbanks, Morse & Co., Vice-President.

W. C. Kidd, Ramapo Iron Works, Secretary.

Communipaw Terminal Facilities, C. R. R. of N. J.

By reason of the demand for increased facilities for rapidly and economically handling locomotives, the Central Railroad of New Jersey has had constructed at Communipaw, N. J., a modern locomotive terminal which for its size, convenience and up-to-date construction is not excelled by any other plant in the country. The work was designed and executed by Westinghouse Church Kerr & Co., engineers and constructors, New York City, in cooperation with and under the direction of Joseph O. Osgood, chief engineer, and A. E. Owen, prin. asst. engineer, of the Central of New Jersey.

The new plant is located on the south side of the main line tracks about one mile west of the passenger terminal and is in close proximity to the freight yards, which are located on the opposite side. Located with the freight yard on the one side and the passenger yard on the other, the terminal facilities are arbitrarily divided so that the freight and passenger engines are handled separately.

The sufficient track arrangement provides the necessary flexibility to permit of the free use of either of the houses for passenger or freight to provide a layout of tracks, leading up and into the terminal, especially designed for the quick handling of passenger power, formerly cared for in the two old engine houses at Fiddlers and Communipaw, located on the north side of the main track, and through which were handled 30,823 locomotives during the first four months of the present year, or an average of 255 locomotives per day. During the summer months the number of engines handled per day is about 300, which includes all the usual performances of cleaning fires, dumping ashes, coaling, supplying sand and water, washing boilers and inspecting, together with any light running repairs that may be necessary.

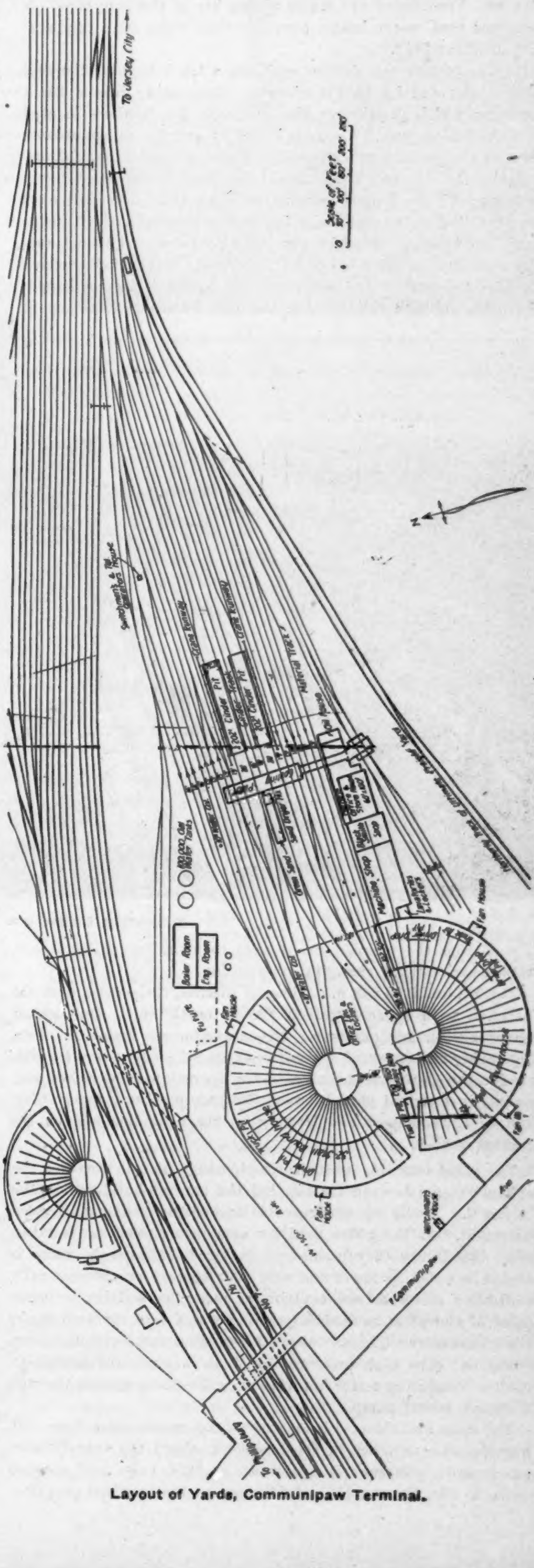
These completed improvements consist of a power house to serve not only the engine terminal but also to take care of all electrical requirements of the railroad from the Jersey City water front to Newark Bay. Two roundhouses, one 34-stall, 100 ft., and one 32-stall, 90 ft., two 100-ft. turntables, machine shop, blacksmith shop, storehouse and office, material platform, oil house, cinder pits, coaling station, sand storage, roundhouse office and toilet building, enginemen's locker building and telephone tower, with all equipment and service inside of building and in yard.

The ground is principally cinder fill, varying in depth from two to ten feet, on an underlying strata of blue clay, sand and bog, except where the old shore line runs across the west end of the property. In consequence all the buildings rest on piles with the exception of the west half of the roundhouses, where the ground conditions are favorable for footings. The foundations of the buildings consist of concrete pile caps and piers where the concentrated loads are imposed, with reinforced concrete wall girders supporting the building walls. The power house, however, rests on a concrete slab 4 ft. thick, extending under the entire building. This slab is supported on piles spaced equally under the entire mattress. All the buildings are constructed of reinforced concrete, steel and brick with steel sash, wooden doors and concrete floor. The roofs of all buildings except coaling station are covered with three-ply asbestos felt roofing.

POWER HOUSE.

The power house is 135 ft. long and 92 ft. wide, with concrete boiler and machine foundations. The building proper is of brick with a structural steel frame for supporting boilers, stock and coal bunkers. Steel sash and doors are used.

Six 250 hp. B. & W. water tube boilers arranged in three batteries of two each are installed, and space is provided for an additional battery. Boilers are fed by two reciprocating, duplex, outside end packed, plunger type pumps, either of which is capable of furnishing the maximum amount of water needed for the boiler plant. Stokers are installed. A lined steel stack



Layout of Yards, Communipaw Terminal.

10' 6" in diameter and 75 ft. in height above the roof furnishes natural draft, aided by automatically controlled turbine type blowers. Feed water and steam piping are of the loop type. A Cochrane feed water heater provides feed water at a temperature of about 200°.

Hopper bottom cars deliver coal into a track hopper; the coal is then elevated by bucket elevator, discharging into a flight conveyor which distributes the coal into the bunkers located over the boiler room. The coal is fed by gravity to the stokers through chutes with gates operated from the boiler room floor.

Ashes are dumped from the stoker into a hopper directly underneath. The hopper terminates in a gate. A bucket on a car traveling on an industrial track is manually pushed underneath the hopper, loaded by gravity with ashes and then manually shoved to a point below an electrically driven hoist, which elevates the bucket and automatically dumps it into a hopper above the railroad siding. Ash and coal handling arrangement is such that the railroad car is used to bring in coal and load with ashes without changing its position.

The 600 kw. 2200 volt a. c., General Electric, turbo-generators are installed with space provided for a fourth unit. One steam driven exciter and one motor driven exciter are installed. Two 2500 cubic ft. compound steam two-stage air compressors furnish air for the engine terminal, also for operation of switches and signals in terminal yard between Communipaw and Jersey City and to Elizabethport and Newark on the main line and on the Newark branch.

The plant operates normally condensing; in cold weather the exhaust steam is used for heating the several buildings in the terminal. A mixing condenser is located in the engine room basement. As the water used for condensing purposes is taken from the Jersey City mains and metered, condensing water is cooled in a cooling tower and used over again. An automatically controlled motor driven centrifugal pump located in the basement of the plant is used for raising water into elevated tanks when necessary. There is also a 1500-gallon underwriters' pump connected onto high pressure fire lines in yard and buildings. Jacket circulating water is returned to the water system through a duplex steam pump.

The main switchboard is located on the engine room floor with high tension switches in the basement where the transformers are located. Current is generated at 2250 volts and stepped down to 550, 220 and 110 volts for use at the terminal proper.

A ten-ton Morris hand-power crane spans the engine room floor.

ROUNDHOUSES.

The roundhouses are constructed of reinforced concrete columns, piers and roof girders, with hollow tile and concrete roofs. The rear wall consists of concrete piers approximately 5 feet wide with steel sash between, with an 8-inch brick wall below these windows. This arrangement permits a maximum window space both for lighting and ventilation. The roof line is broken at the first row of columns at the front of the building so as to give a row of hinged sash over each stall. Additional ventilation is provided for by means of three-chamber four-inch hollow tile set in the rear wall above the windows and in the locomotive door lintels. There are also ventilating openings above the sash in the roundhouse monitors. This arrangement follows Central R. R. of New Jersey standard practice and provides an outlet for any gases that may collect underneath the ceiling, which is a flat arch, giving an unobstructed path for gases to pass out through the ventilator openings. Both houses are heated by the indirect system. The fans and heaters are located in the fan houses, of which there are two in each house. The hot air is delivered through underground ducts and is discharged through outlets located in the pits and around the rear wall. The floor wearing surfaces are concrete throughout and are reinforced along the sides of the pits to provide bearing for jacking. Each house is provided with steam, air and water service on columns.

In addition a boiler washing plant has been installed in connection with the 90 ft. house, which serves 32 stalls. The piping is of such size as to permit of the system being extended to the 100-ft. house should it be desired at a later date.

Asbestos smoke jacks are at present installed, but the roofs of the houses are so designed and constructed that they could sustain the weight of cast-iron jacks should it be found desirable to install them in place of the asbestos jacks.

Both houses are lighted by Tungsten lamps, the wires being carried in conduits under floors and in columns. There is installed in the 90-ft. house one driver and one truck drop pit, and in the 100-ft. house two driver and one truck drop pit, each extending over three stalls, which have pneumatic jacks for wheels and half-ton crane for handling driver boxes, etc.

The entrance doors to the stalls are hinged to lintel posts, which are entirely separate from the building construction

Submerged Cinder Pits With Traveling Crane.

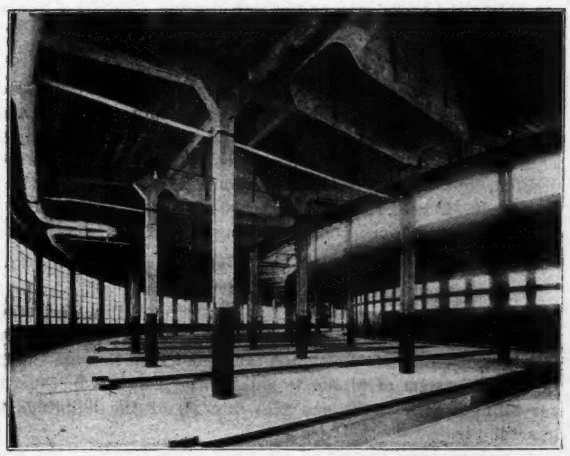
proper, and so fastened to the building columns that the accidental wrecking of a door will not damage the building structure.

TURNTABLES.

Each roundhouse is served with a 100-ft. deck turntable of heavy construction operated by Nichols' electric tractors. Owing to the extreme depth of these turntable pits and the shallow grade of the sewer in the vicinity, it was found necessary to provide against the contents of the sewer backing up into these pits. This was accomplished by constructing a deep sump into which both pits are drained. Automatic ejectors discharge this drainage into the nearest sewer at a higher level.

MACHINE SHOP AND BLACKSMITH SHOP.

Adjoining and directly connected to the 100-ft. roundhouse is the machine and blacksmith shop building. The total length is



Interior of Round House.

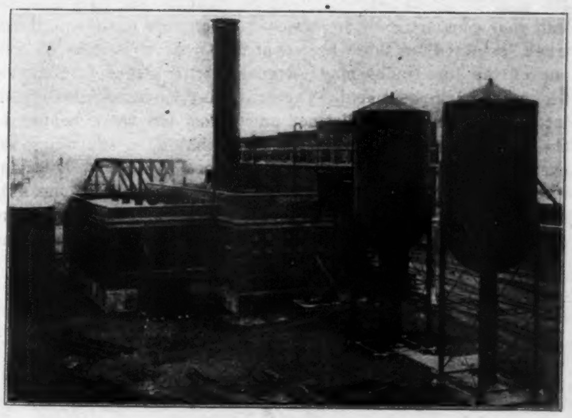
200 ft. and the total width 80 ft., and the height is 28 ft. over all.

A monitor 13 ft. wide extends over the entire length of the building and is provided with continuous top-hunt steel sash, operated from the machine shop floor. Toilet and locker room facilities are provided in a small extension located between the main building and the 100 ft. roundhouse. Access to this toilet room and locker room may be gained either from the machine shop or the roundhouse.

The machine shop space is 140 ft. long by 80 ft. wide and has a concrete floor throughout. The equipment consists of small lathes, crank planers and other similar machines as may be required for light running repairs. Two motor driven line shafts near the north wall furnish power for the small machines, a motor driven wheel lathe for driving and truck wheel work is located near the center of the building and is served by a four-ton overhead trolley. One of the roundhouse tracks is extended through the machine shop into the blacksmith shop.

In the southeast corner of the machine shop space is provided for pipe work. Besides two pipe forges, this space contains an 8-inch pipe machine, pipe racks, benches, etc.

The blacksmith and boiler shop is located at the east end of the building and is separated from the main or machine shop by a fireproof wall. This space is 40 ft. wide and 80 ft. long and the south half is occupied by the blacksmith shop, which is equipped with five down draft forges, each served with a half-ton jib crane. A 2000 lb. steam hammer served by a three-ton jib crane is located in the center of the blacksmith shop space. The equipment of the boiler shop consists of motor driven punch and shears, hand-bending rolls, flangefire and screw flanger. Heating of the building is by direct radiation and lighting by Tungsten lamps varying from 25 to 500 watts. A concrete ramp is located at the northeast corner of the building. This leads to the material platform by means of which material may be



Power House and Water Tanks.

brought directly to the machine and blacksmith shops from the storehouse.

STOREHOUSE AND MATERIAL PLATFORM.

The storehouse is 100 ft. long and 60 ft. wide and directly adjoins the blacksmith shop building. Its construction is fireproof throughout. Steel bins and counters are used for storing material, so that except for any combustible contents the fire hazard is reduced to a minimum. The building is at present one story in height, but the foundation, walls and columns are designed heavy enough for a second story should it be found necessary to construct this addition at a later date. The easterly end of the building is divided by fireproof partitions into offices for the general foreman and the storekeeper and the toilet and wash room. The material platform is 48 ft. wide and 80 ft. long and extends 12 ft. in width along the north side of the storehouse. This structure is built of reinforced concrete and hollow tile with concrete wearing surface.

OIL HOUSE.

For the storage of various kinds of oil used at the engine terminal an oil house is located at the extreme east end of the material platform. This building is 20 ft. wide, 48 ft. long and one story in height, and is provided with a basement 10 ft. high in which the various oil storage tanks are located.

The measuring pumps and boxes for filling the storage tanks are located on the main floor, where space is also allowed for storage of waste and grease cakes. The building is lighted by Tungsten lamps and heated by direct radiation at a high temperature to render the oil fluid in cold weather.

COALING STATION.

The most interesting structure of the group, on account of its size and construction, is the coaling station. The main building spans eight tracks and serves an additional track at each end. The structure is 168 ft. long, 34 ft. wide and 55 ft. high, and is of reinforced concrete throughout. The bunkers rest on special steel I-beam girders encased in concrete, and the hopper bottoms are built of reinforced concrete with hollow tile. The sides of the bunkers are heavily reinforced to withstand the side pressure of the coal when the bunkers are filled. A monitor extending the full length of the structure is of steel trusses with 2 in. plastered concrete sides and is provided with an asbestos roof. The coal is received from the cars by two receiving hoppers, from which it is discharged by means of reciprocating feeders into bunkers containing conveying elevators. These conveying elevators carry the coal to the top of the hopper house, where it is discharged on two 30-inch belt conveyors running up the conveyor bridge over the top of the bunkers. Traveling trippers running on rails above the bunkers discharge the coal into various compartments.

There are three longitudinal bunkers having a capacity respectively of 430 tons of bituminous, 813 tons of broken and

430 tons of buckwheat coal. These bunkers are each divided into four compartments by transverse concrete partitions. Each track is served by three coal chutes so that an engine on any one of the ten tracks may be coaled with either bituminous, broken or buckwheat coal. The conveying machinery is divided into two separate and distinct units from the track hopper to the tripper over the bunker, each unit having a conveying capacity of 100 tons per hour. Provisions are made, however, whereby either track hopper elevator or conveyor of one unit may discharge its contents into the elevator or conveyor of the other unit, and in addition the trippers are so arranged as to discharge into either one of the three bunkers. This flexibility reduces the possibility of shutting down the entire plant, due to a breakdown or other emergency, to a minimum. The entire machinery is electrically driven.

Machine Shop and Round House.

Suitable stairways, platform and walkways are provided, from which an inspection of the apparatus may be safely made while the machinery is in operation. Guards are placed over all exposed gears as a protection to the attendants, and in addition there are 11 emergency stations from which the entire machinery may be shut down by pressing a button.

West of the coaling station and south of the machine shop and storehouse are the coal storage tracks, having a capacity of forty cars. Provisions are made for thawing out frozen coal in the cars on these tracks by means of live steam.

Under the center bay of the coaling station at the ground level there is a toilet and locker room for use of hostlers, cinder pit and coaling station employees.

SAND HOUSE.

Provisions for the storing and drying of sand are made in a building west of the coaling plant. This building is of reinforced concrete throughout and is 103 ft. long, 16 ft. wide and 14 ft. high. The green sand is dried by means of two coal stoves of standard Central R. R. of New Jersey design, located in a separate room in the east end of the building. The dried sand is then screened and elevated by means of compressed air to two storage tanks of 15 cubic yards capacity each, located on top of the coaling station. From these tanks the sand is delivered to the locomotive through cast-iron delivery pipes and wrought iron telescoping spouts serving each of the ten tracks.

CINDER PITS.

The cinder pits are located about 60 ft. east of the coaling plant and are of the submerged type. They are each 200 ft. long, 30 ft. wide and 12 ft. deep, and are heavy reinforced concrete throughout.

Each pit serves two tracks which are 26 ft. center to center. The pits are parallel and are about 58 ft. center to center with a track for cinder cars between. The cinders are cleaned out of the pits by a four-ton electric traveling crane operating a 1⅝ yd. clam-shell bucket. This crane is located on a steel runway 240 ft. long, 99′ 6″ span and 26 ft. above the rail. Aside from the economy and speed in handling engines over the pit, this arrangement permits of the coaling of engines from cars by means of the clam-shell bucket should occasion arise.

MISCELLANEOUS BUILDINGS.

Among the miscellaneous buildings are the enginemen's tool storage building and the roundhouse toilet and office building. These buildings are 20 and 22 ft. wide and 55 ft. and 52 ft. long, respectively.

Both buildings are heated by direct radiation and lighted by Tungsten lights. The enginemen's tool storage building is equipped with steel lockers of special design for storing the locomotive enginemen's tool chests, etc.

The roundhouse office and toilet building is divided by a tile partition into an office room at the east end and toilet and locker room with steel clothes lockers and toilet facilities at the west end. The building is so situated that an unobstructed view of all inbound and outbound tracks in the terminal yards is obtained by the engine dispatcher in the office.

The telephone tower is located at the east end of the yard and the operator has full view of all outbound engines so that he can notify the tower man as to their location. This is a wooden building with the operator located on the upper floor.

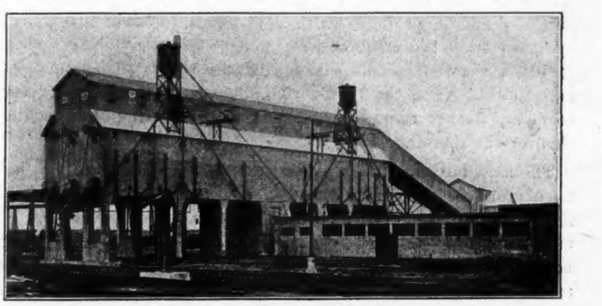
TUNNEL.

A tunnel is provided from the power house to the roundhouse for carrying all steam, air and water service piping, and in addition all wires and cables for light and power in the buildings. This tunnel is of heavy reinforced concrete construction, waterproofed, and is 6 ft. wide, 7 ft. high and 367 ft. long, with a branch 60 ft. long running to the 90 ft. house. The tunnel is well lighted and affords ample working space for making repairs.

WATER SERVICE.

The water piping is divided into two systems. The supply is taken from a 16-inch water main of the Jersey City water service and is discharged by city pressure through altitude valves into two 100,000-gallon steel elevated tanks and then through the low or service system of piping to eight water columns in the yard for filling engine tanks and also into all of the buildings for general use.

A high pressure system of piping is carried around the property and into the various buildings from the fire pump in the power house for fire protection.



Concrete Coaling Station.

SEWERS.

A complete system of sewers has been installed to take care of all roof drainage and all drainage from engine pits, power house, toilets, turntables, etc., and in addition catch basins have been installed throughout the yard for track drainage.

YARD LIGHTING.

The engine terminal yard is lighted throughout by fifteen 125-volt alternating current flaming arc lamps. Four of these lamps are suspended from reinforced concrete poles located around the inner circle of the roundhouses, the remainder being suspended from tubular steel poles located at convenient points. Provisions are made for lowering these lamps to the ground for trimming. All conduits and wires supplying current for this lighting are underground.

Fuel oil is piped from an oil pit of 8,000 gallons capacity located between the west ends of the two roundhouses.

CONCRETE DEPARTMENT

Insulating Concrete Roofs Against Condensation

OBJECTIONS are often raised by engineers and architects to the use of concrete roofs for round houses, power houses and mills because of the condensation which takes place on the ceiling during cold weather. In some cases wooden roofs have been used on concrete structures in order to remove the difficulties attendant with uninsulated concrete slabs. A prominent eastern road uses wooden roofs on round houses otherwise of concrete construction for this reason alone. Such facts would lead one to believe that concrete roofs cannot be insulated to prevent condensation, but this however is not the case.

Condensation takes place in buildings when moist or steam-laden air at a higher temperature than the outer air strikes a cold surface (such as a concrete slab exposed to the outer air) or when the air becomes so heavily laden with moisture as to reach its dew point. In round houses and structures of similar character, a considerable amount of steam is present at practically all times and since the dripping of condensation on the engine jackets and employes is very undesirable, some provision must be made to prevent condensation. As an aid to the prevention of condensation adequate ventilation should be provided in all cases for even with a wooden roof condensation will take place if the ventilation is bad.

Fireproof roundhouses are becoming very popular and will become more so when engineers become convinced that concrete slabs can be insulated to prevent condensation. If the roof slab is built flat some sort of slope will have to be placed on the same to shed the water. About the cheapest way to accomplish this end is to place a layer of cinders on the slab at the proper slopes, covering the same with a 1 in. layer of cement mortar as a base for the tar and gravel roofing. The cinder fill between the two layers of concrete and the roofing acts as an insulator and will under ordinary conditions prevent condensation forming on the under side of the roof slab. Where the winters are severe the placing of a layer of hollow tile directly on the roof slab before filling in the cinders will greatly increase the insulating properties of the fill.

If the concrete roof is sloped for drainage no additional fill is necessary to provide slopes and the insulation which best meets this condition is a layer of hollow terra cotta tile laid on the roof slab, and then covered with a 1 in. layer of cement mortar upon which a tar and gravel roofing should be laid. This is the ideal insulation for sloping concrete roofs since it combines comparatively low first cost with light weight and positive insulation. This type of insulation will cost about 12 cts. per square foot exclusive of roofing; while a plain cinder fill with an average depth of 1 ft. will cost about 10 cts. per square foot exclusive of roofing, and if tile are added under the fill the cost will be increased about 3 cts. per square foot. The last two types of insulation will weigh about 75 lbs. per square foot for a fill 1 ft. deep, while hollow tile 3 or 4 inches thick on a sloping roof will weigh only about 35 lbs. per square foot.

Since roundhouse roofs are generally built with a slope this latter method should prove the cheapest and most popular. The question of insulating concrete roofs is a timely one and we venture to say that wooden roofs will be used very little on concrete round houses in the future in order to sidestep the problem of insulating a concrete slab. Wood has generally been discarded for the permanent fireproof concrete construction in nearly all building work of any importance undertaken by railroads and it should not be used on roofs to do away with condensation troubles until it has been demonstrated that concrete roofs cannot be insulated which we know is not at all probable.

WRECKING CONCRETE BUILDINGS BY TWO ENTIRELY DIFFERENT METHODS.

A few years ago no one gave much thought to such matters as the wrecking of reinforced concrete buildings to make room for new structures. At that time concrete buildings were deemed permanent and it was taken for granted that very few concrete buildings would ever have to be torn down. Progress in building has shown that concrete structures will in the future have to be wrecked to make way for modern structures. For this reason the following methods of wrecking two different concrete buildings will be of special interest to structural engineers.

Wrecking Concrete Building with Dynamite.

In wrecking a one-story reinforced concrete building of the beam and girder type in Baltimore recently, small charges of dynamite were used at the top and bottom of all columns to sever them from the girders. The girders torn loose by the charges of dynamite dropped to the ground and were readily broken up. The floor slabs were broken up by means of heavy sledges before destroying the girder connections with columns. The dynamite severed the column connections, and after dropping to the ground they were broken up with sledges. The cost of wrecking this structure amounted to about $4.00 per cubic yard of concrete contained therein.

Wrecking Concrete and Steel Building by Oxy-Acetylene Torch.

While building the new "Soo Line" freight depot in Chicago it was necessary to wreck a four-story and basement building used as a brass foundry by the Crane Company, to make room for the mammoth concrete structure upon which the freight yards and depots were placed. The building was of steel frame encased in concrete with reinforced slabs between beams.

The oxy-acetylene torch was used to cut all structural and reinforcing steel and while so doing, it was discovered that the flame would cut concrete readily. For cutting concrete it was found that acetylene and oxygen pressures of 20 and 50 lb. per sq. in. respectively, produced the best results. Holes 2¾ in. in diameter were cut through an 8 in. concrete slab and two ¾ in. bars in 2¼ minutes. These holes were cut in the center of panels to give a starting point for the men working with heavy sledges who broke up the entire slab. The I-beams encased in concrete and supporting the floor slabs were cut in 12 minutes. Under the action of the blow-flame the concrete seemed to disintegrate as if it contained water.

Service buildings at Balboa and Gatun are being built of hollow concrete tile. The tile plant at which the blocks are made has a capacity of 2,300 tile per 8-hour day and the average cost of tile is 6.8 cts. each.

Illinois St. Subway, Flossmoor, Ill., Illinois Central

A Reinforced Concrete Subway with Abutments and Curved Wing Walls of Plain Concrete Faced with Dark Red Face Brick to Harmonize with the Station Nearby.

By Albert M. Wolf, C. E.

The Illinois Street subway at Flossmoor, Ill., on the Illinois Central R. R., is an interesting structure of reinforced concrete built in connection with the new station described on page 364 of the July, 1913, issue of *Railway Engineering*. The bridge carrying 4 tracks is 40 ft. wide and 55 ft. long between abutments, made up of two 16 ft. 6 in. clear roadway spans and one 8 ft. sidewalk span. (See Figures 1 and 2.)

The reinforced concrete slabs over the roadway have a maximum thickness of 2 ft. 4 in. at the center with a slope of 2 in. to the ends to provide for drainage. The sidewalk slabs are 2 ft. 2 in. deep at the curb support, sloping to 1 ft. 8 in. at the end of the bridge. At the sides is a parapet wall with inset panels extending about 1 ft. above the base of rail. The reinforcement for these slabs is composed of ¾ in. sq. bars making up 0.9 per cent of the cross-sectional area of the slabs. At the ends of the slabs the bars are bent up to care for shear, while on the roadway slabs additional stirrups are required to adequately reinforce the slabs for diagonal tension stresses. The slabs rest on concrete abutments and two lines of reinforced concrete columns, one at the curb and one at the center of roadway.

The columns supporting the cross-girders upon which the deck slabs rest are circular, with an outside diameter of 18 in. and a length of 7 ft. These columns, spaced 6 ft. centers, are reinforced with eight ¾ in. sq. bars enclosed in spirally hooped cores composed of No. 0000 steel wire coiled at a pitch of 1½ in. At the top the columns are connected by cross girders 2 ft. wide with a circular arch between columns which is 2 ft. thick at the crown. These girders are reinforced with ¾ in. bars so bent as to take care of shear and negative moments over the columns. The roadway columns rest on concrete piers having a 2 ft. 6 in. square hub guard with a 3 in. wash to sides extending 1 ft. above the pavement. The columns and cross girders were poured in Blaw collapsible steel forms built especially for the purpose.

The abutments are built of plain concrete with curved wings

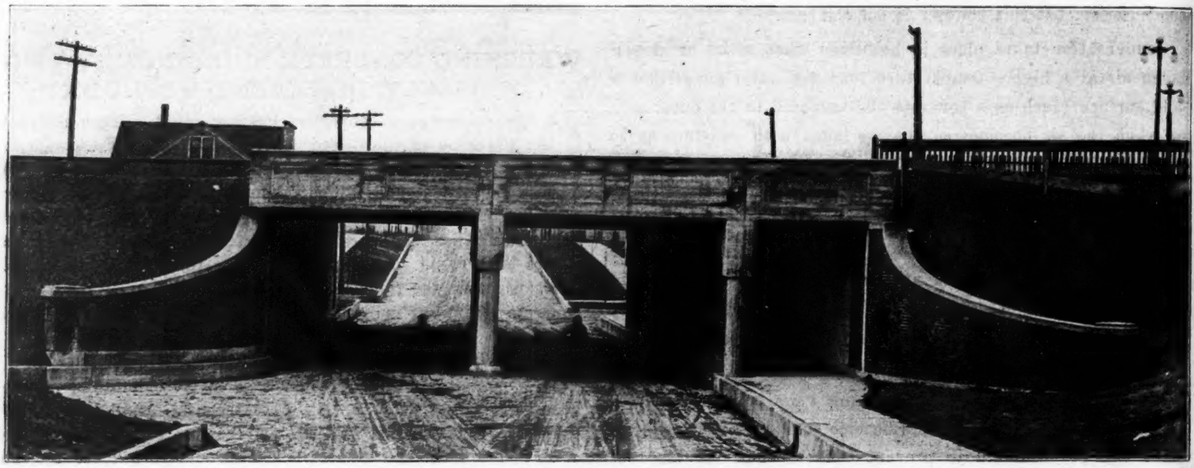


Fig. 1. Illinois St. Subway, Flossmoor, Ill., Illinois Central R. R.—Looking West—Reinforced Concrete Deck Slabs and Piers, Plain Concrete Wings Faced With Brick.

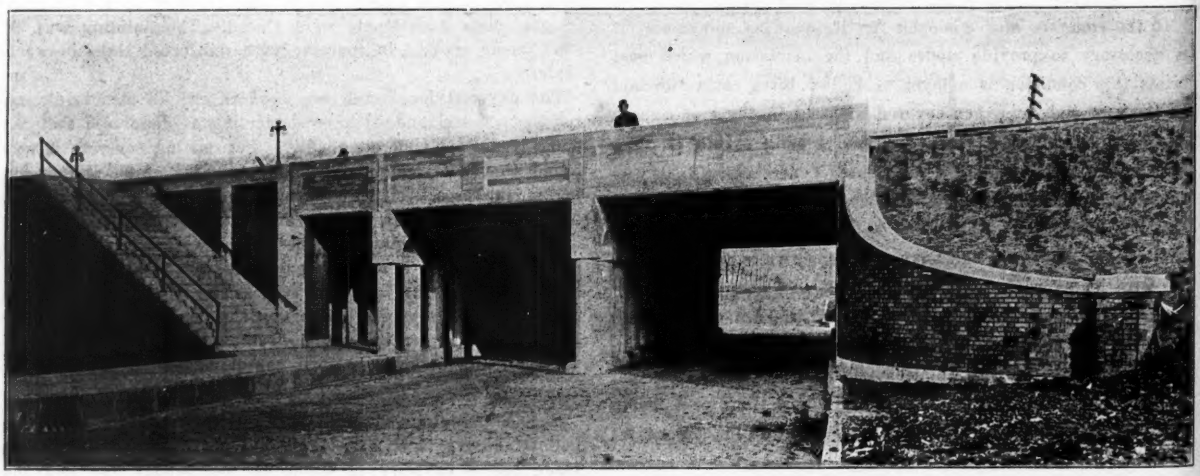


Fig. 2. Illinois St. Subway, West Side, Showing Detail of Roadway Piers.

at the east side of subway; with one curved and one right-angle wing at the west side where the concrete steps to depot platform are placed. The wing walls are faced with dark red brick with a curved concrete coping and a concrete base course. At the ends the wings terminate in paneled brick piers which add greatly to their appearance. The brick facing is returned a few feet under the bridge at each end, producing a very desirable effect. The wing at right angles to the north abutment at west side has a triangular and trapezoidal brick panel to follow the line of concrete stairway to station platform.

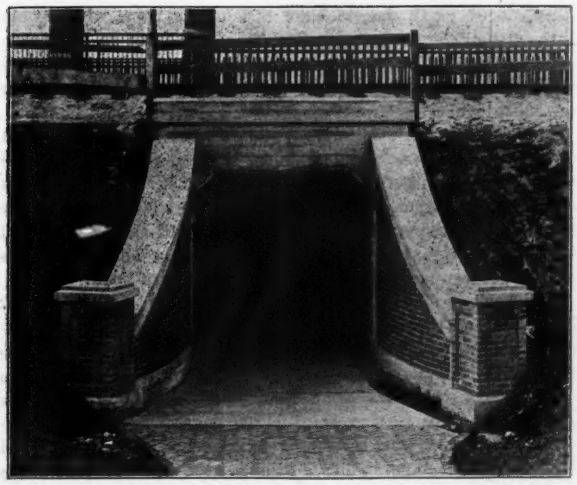


Fig. 3. Reinforced Concrete Passenger Subway at Floosmoor—Wing Walls Faced With Brick.

The bridge floor is covered with Barrett specification waterproofing protected by a layer of concrete upon which the ballast is placed. The roadway pavement is of macadam with combination concrete curbs and gutters at sides. The roadway is given a crown of 1 ft. which gives an underclearance of 12 ft. The sidewalk at the north end of subway is of concrete.

At the north end of the station platform, at some distance to the north of the subway just described, is a reinforced concrete underpass providing an exit for passengers. The wing walls of this underpass or pedestrian subway are given a slight curve and faced with brick in the same manner as the wings of the Illinois St. subway. (See Figure 3.)

Comment.

The use of face brick for decoration or rather architectural treatment of subways is not very common, no doubt on account of the cost of such work. The results obtained in this case fully justify the expenditure as the illustrations show. The elimination of unsightly form marks and monotonous gray surfaces of concrete is sought in all architectural designs and the use of face brick forms a happy solution of the problem.

The writer is indebted to Mr. A. S. Baldwin, Chief Engineer, for data and illustrations used in this article.

PRESERVING AND REINFORCING DECAYED WOODEN POLES WITH CONCRETE.

To prevent the further decay of wooden poles at the ground line, the East St. Louis & Suburban Railway has constructed a special mixing plant to allow the easy transportation of concrete from the mixer car to the base of poles on either side of the right-of-way.

A No. 0 special Marsh-Capron is mounted on one end of a 40 ft. double-truck flat car with a motorman's cab at the other end. Directly behind the cab is a 200-gal. cylindrical tank, the water being forced to the mixer through a small pipe by air under 10 lbs. pressure. The materials for a day's work are carried on the car between cab and mixer. The mixer is charged by means of a loading skip.

The mixer, set up as high as clearances would permit, is operated by an electric motor and under ordinary conditions has a capacity of 6 cu. ft. per minute. The concrete is discharged from the mixer into an open gravity chute 10 in. sq. with a fall of 8 ft. in its length of 18 ft. This chute is pivoted at the mixer and supported near the other end by a guy which permits swinging of the chute and raising and lowering of the same as the conditions require. This outfit has reduced the cost of concreting pole butts to about one-half of the cost of doing the work by hand.

ERRORS IN DETERMINING THE TIME OF SETTING OF CONCRETE.

A paper by G. M. Williams of the Bureau of Standards, Washington, D. C., read before the Am. Soc. for Test. Mat., points out the factors which affect the time of setting of cement, and which acting together or separately account for the variable results obtained on the same material in different laboratories.

The variation in results obtained in this investigation are only to be considered as characteristic of the range which may be obtained in practice.

The following factors may cause errors of considerable magnitude:

1. Variation in the amount of work done on the material may cause a difference of more than two hours in the time of initial setting and cause a normal cement to appear quick setting.

2. Variation in atmospheric moisture or humidity of storage during the setting period may cause the initial time of setting to vary as much as two hours.

3. Variation in atmospheric heat or temperature of storage during the setting period may vary the time of setting as much as one hour or two hours.

The determination is also affected to a less extent by factors peculiar to the Vicat and Gillmore methods.

The important factors are the working of the cement paste, and the temperature and humidity of the damp closet. The other variables, such as formation of the test specimen and manipulation of apparatus, are of smaller importance compared with those of mixing and curing, but these errors may combine to increase those caused by the latter.

The tests as made at present can be relied upon only to identify normal or slow setting cements, and may cause a normal cement to appear quick setting.

The results indicate that neither the Vicat nor the Gillmore method for measuring the rate of hardening, even when all external factors are controlled, will give results consistent enough to justify the reporting of such results within the limits of a few minutes; nor can either method be considered as sufficiently accurate for use as a standard.

FIREPROOF BUNK HOUSES, A. T. & S. F. R. R.

Originally the Atchison, Topeka & Santa Fe Railroad constructed bunk houses for the Mexican section laborers of old ties set up on end. The danger from fire in these houses was great and they were unsanitary to say the least. In some cases the losses by fire were so numerous that old ties became scarce and a new type of bunk house was decided upon which was fireproof and although higher in first cost was cheaper in the end.

The new quarters are built entirely of concrete and are divided into sections for different families. Each section is provided with two windows and a sliding door serves two sections. The houses are built to fit the conditions, some of them consisting of six or more sections.

CURRENT PRICES — CONCRETE MATERIALS.

Portland Cement—The cement market has remained practically the same since last month, except in certain localities, and the demand is about the same; on the Pacific Coast the market is very dull. Prices given f. o. b. cars at points named, including cloth sacks, for which, in general, 40c per barrel (4 sacks) is refunded on return in good condition. Prices per barrel (including 4 cloth sacks) are as follows: Boston, $1.72; New York, $1.58; Chicago, $1.55; Peoria, $1.64; Pittsburgh, $1.55; New Orleans, $1.64 on dock; Memphis, $1.82; Cleveland, $1.63; Cincinnati, $1.68; Detroit, $1.59; Indianapolis, $1.65; Columbus, $1.67; Toledo, $1.59; Dayton, $1.65; St. Louis, $1.55; Milwaukee, $1.64; Madison, $1.62; Minneapolis and St. Paul, $1.75; Montreal, $1.75 to $1.80; Toronto, $1.95; Kansas City, $1.63; Davenport, $1.65; Cedar Rapids, $1.75; Omaha, $1.68; Portland, Ore., $2.30; Spokane, $1.65; Seattle, $2.30; Tacoma, $2.30; Duluth, $1.78.

Crushed Stone—1½ in. stone, prices per cubic yard, f. o. b. cars, in carload lots, unless otherwise specified. There has been a general increase in prices of stone. Boston, 80c per ton at the quarry; New York, 90c to $1.00, in full cargo lots at the docks; Chicago, $1.15; Toronto, 75c per ton at quarries; Spokane, $1.50; Seattle, $1.25; Portland, Ore., $1.00.

Gravel—Prices given are per cubic yard f. o. b. cars in carload lots unless otherwise noted. Boston, 75c; New York, 90c to $1.00, in full cargo lots at docks; Chicago, $1.15; Portland, Ore., $1.00; Spokane, $1.25; Seattle, 75c; Winnipeg, $1.25; Tacoma, 75c.

Sand—Prices are per cubic yard, f. o. b. cars in carload lots unless otherwise indicated. New York, 50c, full cargo lots at docks; Chicago, $1.15; Toronto, $1.15; Portland, Ore., $1.00; Spokane, $1.00; Seattle, 75c; Winnipeg, $1.75; Tacoma, 75c.

Reinforcing Bars—The demand is in general about the same, with a slight increase in certain localities; the prices have advanced 5c per cwt. in the east and middle west. Pittsburgh base quotations on mill shipments f. o. b. cars are from $1.20 per cwt., with the prevailing extras on bars under ¾ inch or base. The following are quotations on base bars per 100 lbs., for mill shipments from other points, f. o. b. cars: New York, $1.36; Philadelphia, $1.35; Chicago, $1.38; Portland, Ore., $2.35; Spokane, $2.20; Seattle, $2.15; Tacoma, $1.85.

Shipments from stock are being made at the following prices per cwt. f. o. b. cars: Pittsburgh, $1.65; New York, $1.85; Cleveland, $1.80; Cincinnati, $1.85; Chicago, $1.65; Toronto, $2.15; Winnipeg, $2.50; Portland, Ore., $2.70; Spokane, $2.50; Tacoma, $2.20; Seattle, $2.15.

Metal Clips for Supporting Bars—$5.50 to $6.50 per 1,000, depending on size.

For the majority of the prices given we are indebted to the Universal Portland Cement Co., Sandusky Portland Cement Co., Concrete Steel Co., American Sand & Gravel Co., Chicago, and F. T. Crowe & Co., Seattle, Portland, Spokane and Tacoma.

Reinforcing bars for mill shipments are in general sold on a Pittsburgh basis; this is, at the Pittsburgh quotations plus the freight to the point in question, and with the following list of freight rates on finished material and the Pittsburgh quotation given, the prices of bars at any of the points listed can be readily computed.

From Pittsburgh, carloads, per 100 pounds to:

Albany	16 cents	Columbus	12 cents
New York	16 cents	Cincinnati	15 cents
Philadelphia	15 cents	Louisville	18 cents
Baltimore	14½ cents	Chicago	18 cents
Boston	18 cents	Richmond	20 cents
Buffalo	11 cents	Denver	84½ cents
Norfolk	20 cents	St. Louis	22½ cents
Cleveland	10 cents	New Orleans	30 cents
Minneapolis	32 cents	Indianapolis	17 cents
Kansas City	42½ cents	Omaha	42½ cents
Birmingham	45 cents		

New Books

THEORY OF ARCHES AND SUSPENSION BRIDGES. By J. Melan. Translated by D. B. Steinman. Cloth, 6x9 ins.; 303 pages, numerous text figures. Published by Myron C. Clark Publishing Co., Chicago. Price, $3.00.

Professor Melan's work on arches and suspension bridges, characteristic of nearly all German technical books, has long been recognized as the best work available on the subject and it is indeed gratifying to have a complete translation by an authority on the subject, Dr. Steinman, presented to the American engineer. Judging from the popularity of the original work, this translation should rank among our most popular reference books.

The orginal work is reproduced without omissions and it therefore gives an excellent idea of the completeness and thoroughness of German technical books as contrasted with some of our American books which show lack of intimate knowledge of the subject in hand. A copy of this book should be in every engineer's library for practically all other works on the subject are based on Professor Melan's book.

The book is divided into sections as follows: (A) The Flexible Arch and the Unstiffened Cable, dealing with general principles only; (B) The Stiffened Suspension Bridge, with a portion giving the more exact theory for the stiffened suspension bridge with examples of necessary computations; (C) The Arched Rib; this section of over 100 pages treats of the general arch theory, the three-hinged arch, arched rib with end hinges, without hinges, the cantilever arch and the continuous arch; (D) Arch and Suspension Systems with Braced Web; (E) Combined Systems; and an Appendix giving the elastic theory as applied to masonry and concrete arches. An extensive bibliography of European literature on the subject adds greatly to the value of the book.

In the portion on suspension bridges the designs of Mr. G. Lindenthal for crossing the North River at New York and the St. Lawrence River at Quebec are used as the principal illustrative examples, which would indicate the American practice in suspension bridge design is looked upon with favor abroad.

The entire work abounds in numerous lengthy and intricate equations and formulae such as are found in most German books. They are essential, however, and make the book all the more valuable since nothing is left to the imagination of the reader. Dr. Steinman has presented the American engineer with a most valuable reference work and has rendered a distinct service to the profession.

REINFORCED CONCRETE RAILWAY STRUCTURES. By J. D. W. Ball. Cloth, 6x8½ inches. 213 pages, numerous text illustrations and diagrams. Published by D. Van Nostrand Co., New York. Price, $2.50 net.

This book, dealing entirely with British practice, is not at all applicable to American practice in reinforced concrete for railway structures, as a casual perusal will show. Judging from the great number of concrete railroad bridges built in this country one would naturally expect this book to deal mainly with this subject. Here the reader will be disappointed, for this portion of the subject is omitted entirely for, as the author says, there are very few reinforced concrete bridges in England carrying railroad lines. This indicates at once how much farther advanced the railroads in America are in regard to the use of concrete structures than are those of England. For this reason the book seems to be misnamed, for the structures described, except in a few cases, are not limited to railroad use but rather a general usage.

The general considerations of reinforced concrete design are first taken up, followed by discussions on design of floors, building foundations, retaining walls, overhead highway bridges of different types, and sleepers and fence posts. The latter chapter contains data which will be of interest to the

American engineer. In view of the many American treatises on reinforced concrete now available which are adapted to our practice it does not seem advisable to recommend this work for extensive use in this country.

FOUNDATIONS OF BRIDGES AND BUILDINGS. By Henry S. Jacoby and Roland P. Davis. Cloth, 6x9 in., 603 pages, 205 text illustrations. Published by McGraw-Hill Book Co., New York. Price, $5.00 net.

This new work on the subject of foundations as represented by American practice is primarily a text-book for engineering students and therefore each subject is treated in an elementary way at the beginning. This, however, is no fault, since the subjects are developed in a careful and systematic manner. The book is well written and illustrated with excellent examples of recent foundation work of various kinds. It contains very little of a historical nature and the first part is noted for its originality and freedom from quotations except from some very good standard specifications; the same cannot be said of the latter part, however. The final chapter, entitled "References to Engineering Literature on Foundations," is very complete and one of the most valuable portions of the book to the student as well as the practicing engineer.

The first five chapters, forming about one third of the book, are devoted to timber, concrete and sheet piles, since in the opinion of the authors "young engineers are more likely to obtain their early experience with pile foundations than with any other class of foundation construction." This may or may not be the case, but the fact remains that these chapters form a most excellent treatise on the subject of pile foundations except for the use of piles for piers and docks, which is not discussed in the same thorough manner as the rest of the subject. The chapter on concrete piles is especially good. In the opinion of the reviewer the authors have overestimated the importance of pile foundations as compared with other types which are becoming more common than the former.

Chapter 6, "Cofferdams," gives some fine examples of timber and steel cofferdams. The succeeding chapter deals with box and open caissons of timber, metal and concrete with interesting examples of the different types. Next follow two chapters on pneumatic caissons for bridges and one on pneumatic caissons for buildings. These contain much information on caisson details and practice and also a short discussion on the effect of compressed air on the human system. The pneumatic caisson as used for buildings, principally in New York, is described and illustrated in a most interesting manner. Pier foundations in open wells, commonly known as the Chicago method foundations, are briefly described, as are the grouting and freezing processes.

With Chapter 12, on ordinary bridge piers, begins the part of the book dealing with the permanent part of foundation work, the previous portion having dealt almost entirely with the preliminary work which must be done in various cases before the permanent part can be constructed. In this chapter nothing is given regarding piers for arch bridges, the text adhering strictly to piers for steel bridges of the truss and girder type. Cylinder and pivot piers are described and illustrated in a short chapter. The chapter on bridge abutments, although containing some excellent examples, is decidedly incomplete as to methods of design of different types. Then again abutments for arch bridges are not mentioned even though the forces to be resisted are of different character than for an ordinary abutment. The material on piers and abutments indicates a lack of familiarity with the subject and a tendency to slight the same, although one of the most important subjects to be considered. For instance, the rigid frame abutments of reinforced concrete now being built extensively by the C. M. & St. P. Ry., the design and details of which was exhaustively treated in an article by Mr. A. W. Hoffmann on pages 100 to 111 in the March, 1914, issue of *Railway Engineering*, are referred to in one case as arch abutments, which they are not.

Floating equipment for subaqueous work and contractor's equipment in general is not treated, nor are methods of quarrying and the use of explosives, which rightfully come within the scope of the book. This book, although excellent for the most part insofar as it goes, shows conclusively that it is absolutely impossible for any one or two men to properly treat the subject of foundations in one volume of ordinary size. The field for a treatise of several volumes is unlimited, and if written jointly by a number of men, experts in their respective lines, would prove a most welcome addition to engineering literature.

A PRACTICAL TREATISE ON SUB-AQUEOUS FOUNDATIONS. By Charles Evan Fowler. Third edition, revised and enlarged. Cloth, 6x9 ins. 814 pages and 477 illustrations. Published by John Wiley & Sons, New York, Price, $7.50 net.

A volume so large and ponderous that it seems it would have been advisable to use smaller type and thinner paper in order to make it of more convenient size. To the reviewer it seems that much old and obsolete data could have been omitted and fresh information other than that gathered from the author's own experience very profitably added. On the other hand the book contains specific advice given in a most direct manner which cannot be found in books founded on the experience of others. Taken as a whole the book is a valuable reference work and a valuable addition to technical literature.

The first chapter on the historical development is very interesting. Important chapters on crib cofferdams, pile driving and sheet piling, both wood and steel, follow. These chapters supply real information on the subject of sheet piling concerning which little has been written. The chapters on cylinders and caissons, and pneumatic caissons deal only with such structures of timber and steel, the more recent type, viz., concrete not being mentioned. This is one of the weaknesses of the book, since reinforced concrete caissons have lately been used in numerous kinds of sub-aqueous work; then again the examples of pneumatic caissons of steel are too old to reflect modern practice. Chapters on driving, removal of old piers, pumping and dredging, drill scows, dredges, tugboats and scows complete what might be called the first part of the work, dealing with the temporary part of foundation work which does not exactly form a part of the permanent structure. The portion on dredges is rather weak in that the latest and most efficient suction dredges are given no mention.

Foundations are next discussed, dealing with the character of soils and bearing capacity. Two chapters on the design and location of bridge piers will be found of interest to the bridge engineer as will the chapter on calculation of piers, footings and retaining walls. Rock fill foundations and quarries, cement and concrete, are general chapters including methods and costs of quarrying and of mixing and placing concrete. Chapters on foundations for piers and wharves, dams, sea walls, breakwaters, docks and locks, include many examples with cost data. This data, however, is rather incomplete and to be used with caution since no dates are given, which is absolutely essential to make it of value. The subject of timber piers and timber preservation is discussed in one short general chapter. Chapter 31 on forms for concrete is a good one, while the succeeding chapters on estimating the cost of construction will be of value if carefully used, for as previously stated dates are missing in nearly all the data. The book closes with eleven appendices consisting of standard or typical specifications for cofferdams, masonry, steel piling, pile drivers, cement, concrete, creosoting piling and a page of data on air compressors; some of these are of considerable value while others might well have been omitted to make room for more important material.

In the opinion of the reviewer, some old and rather superficial material might well have been condensed or omitted altogether. This does not mean, however, that the work is not the best of its kind, for it is, and is worthy of a place in every engineer's library.

TESTS OF BOND BETWEEN CONCRETE AND STEEL. By Duff A. Abrams. Bulletin No. 71, Engineering Experiment Station, University of Illinois. Paper, 6x9 ins. 238 pages. Numerous diagrams and illustrations. Copies gratis, upon application to C. R. Richards, Acting Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

This bulletin furnishes one of the most exhaustive studies of the amount and distribution of the bond stress between concrete and steel which has appeared. The results of tests of about 1,500 pull-out specimens and 110 large reinforced concrete beams are given. The tests covered a wide range of ages, mixes, size of bar, length of embedment, condition of storage, method of applying the load, etc. Both plain and deformed steel bars were used.

Bond resistance may be divided into two principle elements, adhesive resistance and sliding resistance. In all of the tests measurements were made to determine the relation of slip of bar through the concrete to the bond resistance at different stages of the tests. A considerable bond resistance is developed before a measurable slip is produced. It was found that after slipping begins there is a well defined relation between the amount of slip of bar and the bond resistance for small slips. For plain bars slip begins at about 60 per cent of the maximum bond resistance; with further slip the bond resistance increases rapidly until a slip of about 0.01 in. is reached which represents the maximum bond resistance. The amount of slip corresponding to a given percentage of the maximum bond resistance is remarkably constant for a wide range of ages, mixes, conditions of storage, etc. Slip of bar begins at a bond stress equal to about one-sixth the compressive strength of cubes made from the same concrete. The maximum bond resistance is equal to about one-fourth the cube compressive strength.

Twisted square bars were found to be inferior to plain round bars on the basis of bond resistance per unit of area of the surface of the bar.

The usual method of computing the bond stress in a reinforced concrete beam does not take account of all the phenomena of bond action. Slip was first observed in the middle region of the span at loads producing a tensile stress in the reinforcement of about 6,000 lb. per sq. in. As the load was increased slip of bar progressed through the outer thirds toward the ends of the beam. In the beams reinforced with plain bars end slip began at about 67 per cent of the maximum load; for the beams with certain type of deformed bars the value was 51 per cent. In the tests of reinforced concrete beams it was found that a very small amount of end slip represented critical conditions of bond stress.

This bulletin contains a wealth of information on the subject and in view of the fact that some of the results are contradictory to the commonly accepted views, it should be carefully studied by every engineer engaged in concrete design and construction.

SUSPENSION BRIDGES, ARCH RIBS AND CANTILEVERS. By Wm H. Burr, C. E. Cloth, 6x9 inches. 417 pages, illustrated. Published by John Wiley & Sons, Inc. New York. Price $4.50.

A text written primarily for the author's class-room needs, but nevertheless a valuable reference work for the practicing engineer. The writing of a text on statically indeterminate trusses for the use of students is no small task, since extensive mathematical analysis cannot justly be entered into, but nevertheless they cannot be dispensed with, and to strike the mean has been the endeavor of the author. The book is entirely theoretical, no details of design being given and only a few examples and questions of design are touched upon.

The first chapter is devoted to the approximate theories of stiffened suspension bridges, based on assumptions so as to treat each part as statically determinate. The theories given are suitable for use in making estimates for such structures. The next chapter treats of the theory of stiffening trusses, with center hinge and three hinged with equations for moments and shears. Chapter 3 deals with the general problems involved in computing stresses and deflections in cables, frames and chains. The treatment of statically indeterminate stiffening trusses which follows is quite elaborate and extensive and based on the theory of least work. The application of influence lines for finding shears, moments and deflections is an important part of this chapter. Chapter 5 is on the theory of the straight stiffening-truss based on the method of deflections, while the next chapter deals with thermal stresses.

Arch Ribs Treated by Graphical Methods is the title of Chapter 7. The various stresses in arch ribs with fixed and hinged ends are discussed, both for general cases and for reinforced concrete. The general analytic theory of elastic arch ribs according to the Law of Least Work follows. Chapter 9 presents graphical and analytic treatments of three-hinged arch ribs, and Chapter 10 the theory of the braced spandrel arch. The final chapter treats of the analytic theory of cantilevers in general, the economic lengths of spans and arms, and the cantilever without suspended span.

The appendices, two in number, deal with the limiting spans and depths of stiffening trusses and formula for reinforced concrete.

The comprehensive and concise way in which this difficult subject is handled make the book of much value to the bridge engineer. Although it is not what one would term easy reading, on account of mathematics involved, the subject matter is presented in a clear and forceful manner. Not many engineers are called upon to design suspension bridges, but this very fact should make every engineer desire to have a copy so that he may at least familiarize himself with the methods of computation.

The typography and arrangement of the book are excellent, and no doubt involved an enormous amount of labor on account of the great number of formula and equations given.

THE DESIGNING AND DETAILING OF SIMPLE STEEL STRUCTURES. Third Edition. By Clyde T. Morris. Cloth, 6x9 inches. 260 pages, numerous text illustrations and diagrams. Published by McGraw-Hill Book Co., New York.

A book designed primarily for the student dealing with the design of simple steel structures such as are taken up in the course of study in technical schools, a knowledge of the primary stresses in structures being presupposed. The text is naturally rather elementary in character and consists mainly of illustrated examples of structural designs carried out step by step.

Chapter 1 is a short and superficial chapter dealing with designing and estimating. The next chapter on riveting is exceeding good and the treatment is better than that found in some reference works of a more extensive character. Chapter 3 on mill buildings treats mainly of the design of steel roof trusses. The chapter on plate girder bridges is one of the best in the book, giving theoretical considerations and illustrative examples of design, the method set forth following very closely that found in Johnson's "Modern Framed Structures." Chapters 5 and 6 take up the design and details of pin connected railroad bridges. The next chapter on highway bridges is very short and general in character. The final chapter on manufacture and erection, which is of value to the student and young draftsman, is followed by an appendix containing general specifications for Steel Highway Bridges, published by the Ohio State Highway Department in 1911. These contain the usual information with recommended types of bridges for different spans.

The book is well arranged and made up, and should prove of value to the student, but it can hardly be classed as a reference work for engineers.

The Maintenance of Way Department

Expense Chargeable to Creeping Rails

THE causes of rail creeping have been pretty well covered in the articles already published in the series on this subject. The creeping of rails will vary from about 3 in., which is light, to as high as 20 ft. per month, which, of course, is a very extreme case, and occurs only on structures where the rail is not anchored, but is allowed to run freely.

Rail creeping is frequently the cause of trouble which is charged to other conditions, such as tight or loose joints, which are often wrongly charged to incorrect allowance for expansion.

The cost chargeable to creeping track is rather hard to obtain, due to the fact that it is not always credited as the cause of defects being remedied. Creeping track slews joint ties on broken jointed track, and sometimes these ties must be straightened and spacing done two or three times per year. With square joints the conditions are even worse if one rail creeps faster than the other, as is frequently the case. The cost of maintenance under these conditions is greatly increased. The time, however, is usually charged to "straightening ties," "general repairs," or other headings which do not indicate the cause of the trouble.

Data, however, has been obtained of one instance where the actual saving was at the rate of $879.80 per mile per year. The following details show the distribution of expense in two adjacent sections of the same track, charging the entire cost of anti-creepers against one year.

COST OF ONE YEAR'S MAINTENANCE.

TRACK HAVING 640 ANTI-CREEPERS PER MILE.		TRACK WITHOUT ANTI-CREEPERS, PER MILE,	
640 anti-creepers	$115.20	Re-spacing joint ties, twice	$527.00
Applying at ½c each	3.20	Driving rail back, twice	223.20
Re-surfacing	248.00	Re-surfacing, twice	496.00
	$366.40		$1,246.20

The Northern Pacific Ry. spent $8,600.00 during the year 1910 in driving back steel on the Seattle division, covering about 84 miles of double track, due to creeping rail. This was an annual expense. In 1910 they applied about $10,000.00 worth of anti-creepers and they have had no trouble from rail creeping since, and the anti-creepers have required absolutely no maintenance. In other words, the Northern Pacific has saved $8,600.00 per annum by applying $10,000.00 worth of anti-creepers, and the anti-creepers will last ten years, or the life of the rail, and most of them be capable of reapplication.

The above costs are authentic, and show in the latter case, which is a minimum, a saving of nearly the entire cost of the anti-creepers in one year.

The publication of actual costs should prove of considerable use to trackmen who are unable to obtain the necessary anchors for track where a great saving could be shown. A tabulation from daily reports will show at least a part of the expense chargeable to rail creeping in a year's time, and this will give a basis for a strong argument to the higher officials.

The collection and publication of these data are inspired by the fact that the thirty odd trackmen submitting articles on rail creeping are practically unanimous in the opinion, "If the railways would do their share to stop rail creeping, foremen could maintain track better and easier," which is the exact words used by one foreman.

However, to be really economical, a rail anchor, like any other track appliance, must be simple enough to be understood by the laborer, must be easily applied, and must be permanent and positive. Other considerations are the necessity for being self-maintaining and durable enough to last as long as the rail; there is no economy in applying a device which will eliminate the maintenance charge against rail creeping, and transfer the same charge to maintaining anti-creepers.

The readers of RAILWAY ENGINEERING are invited to send in authentic figures on costs similar to the above, showing a comparison between the cost of maintaining track with and without rail creeping.

RAIL CREEPING No. 12.

J. W. Powers, Supervisor of Track.

Every track man knows how difficult it is to hold rails in place. On heavy descending grades, where track is laid in soft, swampy land, poor subgrade with improper drainage, poor ballast, light rail, sudden changes of atmospheric temperature, improper provisions made for expansion, the continuous application of brakes required on steep grades, trains are frequently brought to a sudden stop—these cause creeping rails to give the greatest trouble. The severity of the trouble also depends greatly upon the weight of motive power, car loads and the speed and number of trains. The creepage is greatest on a descending grade and in the direction of traffic, and the lighter the rail the greater the tendency to creep. If we could have rails that would sustain the loads that pass over them without bending or deflecting under them, then we would have no rail movements.

Preventing the movement of rails is a problem which has for years perplexed track men. If some of the older employes will look back 20 or 25 years and compare the methods and devices in use at that time to prevent rail creeping with those of the present, they must observe a wonderful change for the better.

Attempts were made some years ago to hold rails by anchorage on heavy grades by putting a rod through the holes in the fish plates and fastening this rod to a large tie or timber which was sunk in the ground. Another method was to drill holes in rock into which iron bars were inserted and secured by pouring in hot lead, and fastening the other end of the bar to the joint plates. In some places where rock could not be found, concrete was used. But these methods were a failure because each rail could not be secured as the expense of anchorage would be too great. Furthermore, the rod was broken or the bolts broke at the joint anchorage or at some joint below it. Were it economy to anchor every joint, these methods might have prevented creeping.

After the advent of angle bars, where track was laid with broken joints, a hole was drilled in the center of the rail opposite to the joint ties and short bars used, slot spiked, to prevent them from slewing. The majority of angle bars designed for light rail were for a two-tie suspended joint. In this manner four ties in each rail were slot spiked and this checked creeping to a great extent, as it more than doubled the resistance.

However, the increasing loads of the rolling stock created a demand for a more substantial track. Rail sections have increased in weight and height to meet this demand. Better ties and ballast are furnished. While these improvements greatly increase the resistance against rail creeping, they do not entirely eliminate it.

The evil effects of the damage created by creeping rails is ever evident, and may be summarized as follows: The joints buckle, bolts are broken, large openings are sometimes left at joints, the ties become bunched, especially those at the joints, the ballast is displaced, the line and gauge is destroyed by the twisting of ties, and in severe cases rails are pulled apart to such an extent as to make it extremely dangerous and unless discovered, derailments will occur, and the track is left so badly out of line as to make it unsafe for the movements of trains. Difficulty in movement and in some cases the failure of switches to work, especially those in connection with interlocking plants, together with crossing frogs getting in bad line, can all be charged to the creeping of rail.

Very often we will find a succession of joints jammed up closely with the ends nearly welded, so to speak, and again we will find several open joints. This should not be, and the spacing should be regulated as soon as possible and particular pains should be taken to make correction as permanent as possible. An excessive open joint is a very bad feature and if allowed to remain in track, will cause wheels to pound down and batter rail ends and frequently bolts are broken and rails pulled apart. Wheels dropping into the open joints strike the rail ends with such force as to shatter the fibres of the iron and increase the liability of fracturing or entirely breaking both angle bars and rail.

Track laid too close in cold weather, will cause much trouble as the weather becomes warmer, for unless there is sufficient room for expansion, the track is forced out of line to such an extent as to become extremely dangerous. There are many cases on record where track men have been the means of preventing serious accidents to trains by discovering such conditions in time to flag trains and make necessary repairs. I remember some years ago on one occasion where two panels of track were thrown badly out of line. It had moved about three feet from the center of the road-bed and formed a letter S. This track was well ballasted and there was sufficient opening at the joints, but the angle bars had become set and rusted. After the bolts were loosened and the angle bars struck with a spike maul, the track was put in line without cutting any rail.

During hot weather I have found track working out of line with sufficient opening at joints to allow for expansion. After loosening bolts, the rails would not move until the angle bars were given two or three blows with a sledge, after which the rail would jump together and in many cases would make a report as loud as the explosion of a torpedo. It is, therefore, an absolute necessity to loosen track bolts, strike the angle bars with a hammer and retighten the bolts. This should be done during a warm day in the spring and a cold day in the fall, thus avoiding undue stress on rails and permitting them to adjust themselves to the season's temperature. In summer, only the bolts on open joints and in winter those on closed joints need be loosened.

One of the many problems confronting track men is to find means to prevent rail creeping. We can at least lessen the creepage in the following manner, which we believe is a step in the right direction: When laying new rails a foreman should use a thermometer to ascertain the temperature of the rail. Iron shims should be used to make provisions for expansion and contraction. Rails should be alternate (broken joints) and fully bolted as the work proceeds. Care should be taken to have the joints within 3 in. of the center of the opposite rails. Tie renewals, spacing, surfacing, gauging and lining should follow rail-laying closely, in order to hold the openings at joints uniform. In order that proper expansion and contraction may take place, the nuts should only be brought to a snug bearing on the angle bars or nut lock, if nut locks are used. But it often happens that men are allowed to screw on the nuts as far as their strength will permit and in some cases pieces of pipe are placed in the track wrenches to give more leverage. This places the bolts, nuts and locks under severe strain and destroys the elasticity to such an extent that the rail cannot contract and expand freely, and the first abrupt change in temperature is liable to cause the bolts to break. On double track the outside spikes should be driven on the receiving side of the tie and ties should be tamped hardest on the leaving side.

The most pronounced case of rail creeping that has ever come to my notice was on a branch line laid with 70-lb. 33-ft. rail, three tie supported joints, angle bars 36 in. long and slotted for spikes. It was a single track with about 75% of the trains moving in the direction of the grade, which was very light. The track was laid on a very soft, springy bottom, which consisted of black muck several feet in depth. The right of way and the land adjacent to same was covered with water during the spring months. This was caused by the water rising in a lake close by, which flooded the marshes for a distance of about three miles, parallel to the track and up to it. The creepage was most severe during the high water, as the wave motion of the track was greatest at this season of the year, due to the soft condition of the roadbed. So severe were the rail movements, it was sometimes necessary to space ties twice each year. The track was ballasted with cinders and when it became necessary to space and straighten slewed ties, the track was raised three or four inches, after which it was back-filled. A gravel pit was discovered a few miles from this point, and in a small portion of it were found some large cobble stones, which were of no benefit for ballast, but which we were obliged to remove with steam shovel in order to preserve the face of the pit. These we used to strengthen embankment and raise track through the swamp where rail was creeping. The track was lifted from 12 to 18 in. on these stones. We unloaded sufficient gravel to raise the track about four to six inches, after which we placed six rail creepers to each rail, which prevented further creeping at this point.

The earlier types of anti-creepers were inefficient and required so much maintenance that it was a question as to whether the application of the anti rail creepers was economy or not. Many roads were very much in need of creepers, but purchased none because of the poor results obtained from the earlier types or designs. The efficiency of the present day designs and the satisfactory results obtained from their use has dispelled any skepticism regarding the economy of anti creepers.

Medium rail creeping can be greatly reduced, if not entirely eliminated, without the use of rail creepers. But having a part of the evil still remaining where heavy creeping tendencies are encountered, we can only hope to successfully prevent rail creeping under severe stress by the application of anti creepers. So many failures in such devices have occurred that trackmen are loathe to give their approval of any until they have proved their worth or success in actual practice.

It has been demonstrated by extensive experiments that properly designed creepers will successfully overcome creeping with little or no maintenance and at a minimum cost of application. Perhaps the best evidence of the economy and efficiency of the use of well designed anti-creepers is in the large number purchased and used on some of the most important railroads in this country. With the increased speed of trains, weight of cars and powerful engines and double trackage, it has, in recent years, become more and more apparent that good rail anchorage is an absolute necessity.

RAIL CREEPING NO. 13.

Fred Kimball, Foreman.

There are several causes of rail creeping and a good many methods of preventing it. One reason, I think, for the severity of rail creeping is poor maintenance, due to the efficiency of the foreman not having kept pace with the development of motive power and train speed.

In spacing ties on single track men should work against the heaviest traffic, and on double track always work against traffic, filling and tamping each joint as soon as spaced.

Track should never be raised so high that there is insufficient material to tamp it and fill it properly, for open track will creep much faster, and after once started is hard to hold.

Rail anchors are of great value if applied by a good trackman, but represent money thrown away if sent to an incompetent foreman, as they will not then be properly applied, and will probably drop off and be picked up and shipped away as scrap.

STAFF MEETINGS FOR MAINTENANCE OF WAY DEPARTMENT EMPLOYES.

J. T. Bowser, Maintenance of Way Dept., Queen & Crescent Rte.

It is now quite a general practice among railroads or other corporations maintaining more or less extensive organizations to call together the heads of the various departments for discussion of matters pertaining to the business of the organization. Why should not such a practice be extended to the maintenance of way department with good results? Meetings attended by section foremen, extra gang foremen and road supervisors, presided over by the roadmaster or division engineer, could not fail to be of considerable benefit to the department as a whole.

It should not be a difficult matter to arrange for such meetings at stations suitably located for the men to get in and out on trains with the smallest possible loss of time. Long divisions could be covered by several meetings. No doubt the managements of the majority of railroads will very readily authorize an arrangement by which the expenses of men who have to be away from home will be paid by the railroad company, so that there will be no expense to the men.

Such occasions offer unparalleled opportunities for outlining policies and explaining reasons for such policies, thus insuring a better following out of these policies. When these matters have been disposed of, the floor should be thrown open to the men for general discussion of any question on which they may desire information.

They should be encouraged to describe their methods and to comment on methods described. Their relations to each other, with the road supervisor, with the office and with the division officer should be discussed. New men should be encouraged to ask questions, and all complaints should be freely discussed and investigated.

The men should be encouraged to make note of conditions involving the safety of employes or others, or in any matter in which the company's interests are involved. Any recommendation should be acknowledged, discussed, and, if not adopted, the reason for not adopting it should be explained.

These meetings, held three or four times a year, will wonderfully improve the spirit and personnel of the organization. The men will become acquainted with each other, with road supervisors and with division officials. Their interest in their work and in all matters involving the company's interests will be greatly increased. A general rise in the tone of the organization will be readily noticed.

Men who have been in the rut of old methods for years will pick up ideas of the improved methods; the "hard-headed" foreman, who cannot be taught or instructed in the usual manner, will assimilate ideas that he might never get otherwise.

DEVELOPING YOUR OWN TRACK FOREMAN.

By W. E. Norman, Track Foreman Hocking Valley Railway Co.

It does me good to read of the success a great many trackmen are making in the various ways of doing their work. But nevertheless how many of us stop to think or try to solve the question that we can all ask very easily, of how and where are the railway companies going to procure their track foremen after we are past and gone? No one is making an effort to help us out. We must realize that we cannot be out on the track forever and we all know that we cannot go to a college to learn the work and make a success of it. I find it impossible to get a good young American man to work for us on the section, like we used to do, who will eventually develop into a foreman. This was the case even when we were receiving much smaller wages than the companies are now paying. But we find that foreigners are grasping the opportunity of this work and are being promoted to foremen every day. Now, it is my idea to let the company give the supervisor authority to put one good, young American man in the gang controlled by his best foreman, and pay this man 15 cents more per day than the other men for a certain length of time. Let the foreman show him and teach him the work. At the end of 3 or 6 months, if the foreman thinks he can make a track man out of him, increase his wages to 25 cents a day more than the other men, and let him remain at this until a track foreman is needed. Then go to one of the section gangs and pick out a good, young foreman who has been raised and educated to do the work by this method. After a time your supervisor will be the proudest man who rides over the road. Why? Because he has a number of good, young American track foremen who are good for 20 years of work, and therefore make a success for the company and of the supervisor. To all them will be the chance to grasp the opportunity as the foreigners are doing today.

These foreign-born foremen cannot read the book of rules, much less interpret it, as well as native Americans can. This should put a stop to many wrecks that are laid to the cause of bad track but should properly be charged to the ignorance of foreign-born foremen who do not know the first principles of either track work or of flagging trains.

The track foreman's position is one of the most responsible on the railroad and it does seem that the attention has not been given to the development of the right type of men for the position that it deserves.

RAILWAY CONSTRUCTION.

The Ashley, Drew & Northern will build an extension via Rison and Sheridan to Little Rock, Ark., it is said.

The Atchison, Topeka & Santa Fe will expend $40,000 for yard extensions at Florence, Kan.

The Atlantic, Waycross & Northern has under construction a line from Knigland, Ga., to Tolleston, Ga., a distance of twenty miles.

The Baltimore & Ohio is making runways for new branch line for North Sewickley, Pa., to Benets along Brush Creek.

The Beaver, Meade & Englewood has finished grading work on the section from Beaver, Okla., north to Forgan. Contracts have been let to John L. Love, Oskaloosa, Iowa, for the track laying.

The Birmingham, Selma & Mobile will construct a 17-mile line from Brent, Ala., to Marion, with its own forces.

The Canadian Northern has finished grading work on the line from Bienfait, Sask., west to Estevan, about 8.5 miles. The work was carried out by the Western Canada Construction Company, Winnipeg, Man.

Townships in the eastern part of North Carolina have voted to issue $275,000 in bonds to aid the Central Carolina in constructing its proposed 110-mile railroad. W. J. Edwards, of Sanford, N. C., is interested.

The Cleveland Underground Rapid Transit may start work in October on a subway system at Cleveland, O.

I. H. Fetty, of Kansas City, Mo., and associates will build a 15-mile railroad from Conroe, Tex., to timber lands, it is reported.

The Denver & Rio Grande will do considerable building in northwestern New Mexico during the next two or three years, it is said.

Stocker & Frazer, Continental building, Denver, have been awarded the contract for remodeling depot for Denver Union Depot Company.

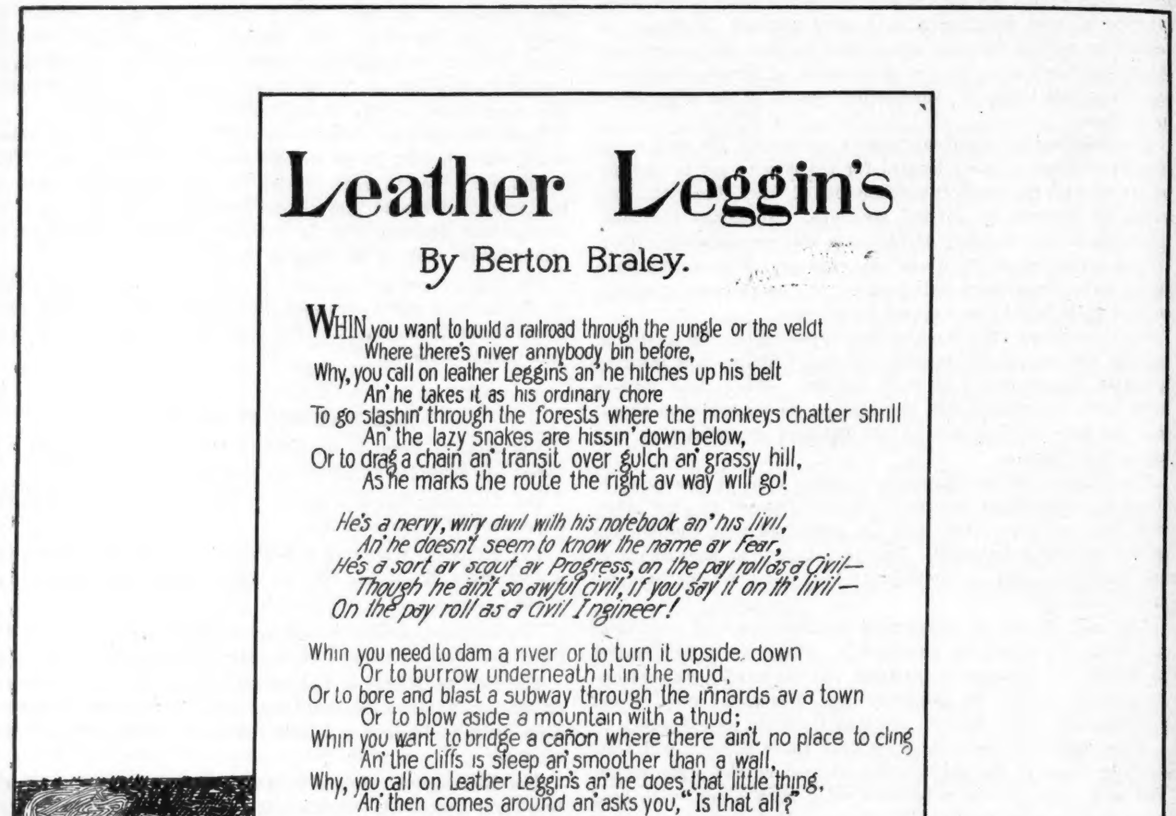
The Georgia & Florida is reported to have made survey to build an extension into Savannah, Ga.

The Glengarry & Stormont has work under way building from a point about a mile west of Polycarpe station, Quebec, on the Canadian Pacific to Cornwall, Ont. The Glengarry Construction Company, Montreal, Que., has the general contract.

The Gulf, Freeport & Northern has run a survey for its proposed line as far as Rosenberg, Tex. C. L. Sharp, Freeport, Tex., general manager.

- NIGHT EDITION -

The Engineer's Distress.



Leather Leggin's

By Berton Braley.

WHIN you want to build a railroad through the jungle or the veldt
Where there's niver annybody bin before,
Why, you call on leather Leggin's an' he hitches up his belt
An' he takes it as his ordinary chore
To go slashin' through the forests where the monkeys chatter shrill
An' the lazy snakes are hissin' down below,
Or to drag a chain an' transit over gulch an' grassy hill,
As he marks the route the right av way will go!

He's a nervy, wiry divil with his notebook an' his livil,
An' he doesn't seem to know the name av Fear,
He's a sort av scout av Progress, on the pay roll as a Civil—
Though he ain't so awful civil, if you say it on th' livil—
On the pay roll as a Civil Ingineer!

Whin you need to dam a river or to turn it upside down
Or to burrow underneath it in the mud,
Or to bore and blast a subway through the innards av a town
Or to blow aside a mountain with a thud;
Whin you want to bridge a cañon where there ain't no place to cling
An' the cliffs is steep an' smoother than a wall,
Why, you call on Leather Leggin's an' he does that little thing,
An' then comes around an' asks you, "Is that all?"

Oh he always has a fire in his old an' blackened brier
An' he tackles anny job that may appear,
An he does it on the livil, this here divil of a civil—
Though he ain't so very civil, if you put it on the livil—
This here divil av a Civil Ingineer!

Now the bankers down in Wall Street gits the profits whin its done
While us heavy-futted diggers gits the can,
But we lifts our hats respectful to the Ingineer, my son,
For that feller, Leather Leggin's, is a Man!
Yes, he takes a heap av chances an' he works like Billy Hell
An' his job is neither peaceable nor tame,
But you bet he knows his business an' he does it mighty well.
An' I want to give him credit fer the same!

He is plucky— on the livil—and you'll niver hear him snivel
Though Fate does her best to put him in the clear,
He's the grit that never flinches - on the pay roll as a Civil—
For he's sometimes pretty civil an' he's always on the livil—
On the payroll as a CIVIL INGINEER!

[POPULAR MAGAZINE]

The Signal Department

Jamaica Signals and Interlocking, Long Island R. R.

At Jamaica, on the Long Island R. R., there are four electro-pneumatic interlocking plants, one east and three west of the station, in addition to numerous electro-pneumatic automatic block signals. As shown in Figure 1, the interlocking plant east of the station, known as "JE," has a machine with 60 working levers and 11 spare spaces controlling 36 switches, 3 derails, 7 double slips with movable point frogs, 29 high signals and 27 dwarf signals. This plant governs switches and signals for train movements to or from Rockaway Junction, Springfield Junction and the station, as well as all main line movements between Jamaica, Montauk Point and intermediate stations.

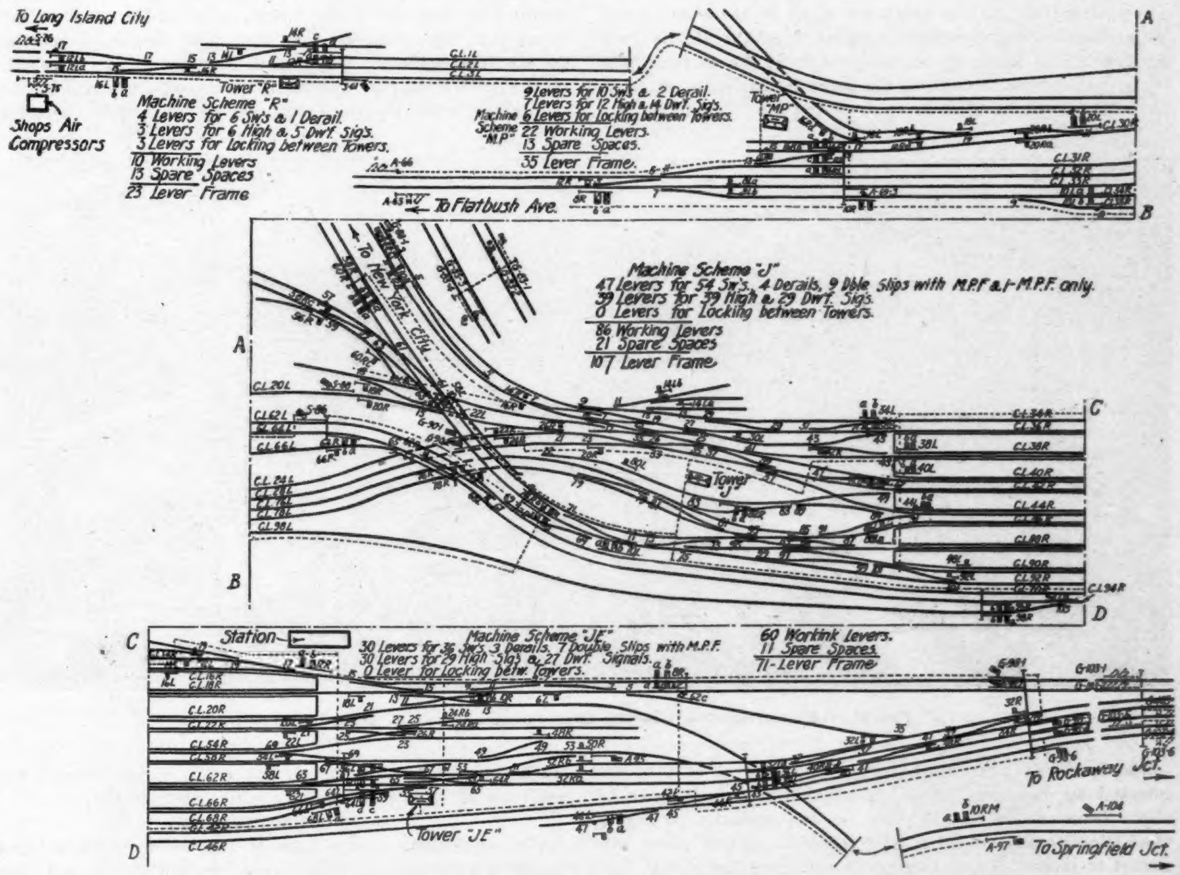


Fig. 1. Layout (Single Line Plan) of Jamaica Terminal, Long Island R. R.

The largest plant in the entire installation, known as "J," is at the west end of the station platforms at the junction of the lines from 33d street, New York, Long Island City and Flatbush avenue, Brooklyn. The machine has 87 working levers and 21 spare spaces controlling 54 single switches, 4 derails, 9 double slips with movable point frogs, 1 pair of movable point frogs only, 39 high signals and 29 dwarf signals. This plant handles all traffic between New York, Flatbush terminal, Brooklyn, Long Island City, the storage yards and Jamaica station or points east thereof, as well as all movements west from the station.

Two interlocking plants are provided west of "J" interlocking, one near Morris Park Station, known as "MP," and the other on the line to Long Island City, known as "R" interlocking. The machine at "MP" has 22 working levers and 13 spare spaces, controlling 10 single switches, 2 derails, 12 high signals, 14 dwarf signals and locking between towers for six tracks. The machine at "R" is the smallest in the installation. It contains 10 working levers and 13 spare spaces controlling 6 single switches, 1 derail, 6 high signals, 5 dwarf signals and the locking between towers for three tracks.

Figures 2 and 3 convey a very good idea of the arrangement of tracks, switches and signals at "JE" interlocking east of the station, and Figures 4, 5 and 6, interlocking west of the station. Figure 7 is a view of one of the signal bridges at "MP" interlocking.

INTERLOCKING TOWERS.

The interlocking towers are each two stories high, made of brick and are of artistic design. The upper floor of each building is used to house the interlocking machine, while the ground floor is used for the motor generators, switchboards and cabinet holding relays, fuses, etc. Figure 8 shows one of the electro-pneumatic interlocking machines, lever lights, track diagrams, etc., at "J," while Figure 9 shows the relay cabinet, motor generator and switchboard on the lower floor of tower "J," this being typical of the arrangement at each plant. All

of these buildings are provided with a basement in which are placed the storage batteries, transformers, etc., together with the heating apparatus and work shop for maintainers.

POWER SUPPLY AND DISTRIBUTION.

Electrical power for a. c. track circuits and lights is supplied from the Woodhaven sub-station and transmitted to the various plants at 2,200 volts, 25 cycles, a. c. It is stepped down by oil-cooled static transformers to 220 volts for lights, to operate the motor-generator sets and for distribution throughout each individual plant to small air-cooled transformers which supply the track circuits. The motor-generator sets supply direct current at 12 volts for the control of all switches and signal units, through the medium of storage batteries.

Compressed air for the operation of all of the electro-pneumatic switches and signals is supplied from the Morris Park car shops. The motor driven compressors at the shops furnish air for general use throughout the shops for car cleaning, pneumatic tools, etc., in addition to supplying the interlocking.

storage battery has sufficient capacity to operate all signal lights, as well as the interlocking itself, for several hours.

The arrangement just described is installed at the two larger plants, known as "J" and "JE." At the smaller plants, "MP" and "R," the emergency lighting is done by direct current from the batteries themselves, since at these interlockings the load is so light and the distance so short that 12-volt d. c. lighting in this manner is perfectly feasible.

Wooden conduits are used throughout for housing wires and cables extending from the interlocking towers to the various units, with the exception of the main conduit at "J" and "JE," where tile, laid in concrete, is used for the main runs passing under the tracks. At these places brick manholes are installed on each side of the tracks, with the tile conduits, laid in concrete, approximately four feet under the ties, connecting the manholes together. The wooden conduits which run parallel to the tracks on pipe carrier foundations above ground are terminated in the manholes near the top. All branch conduits,

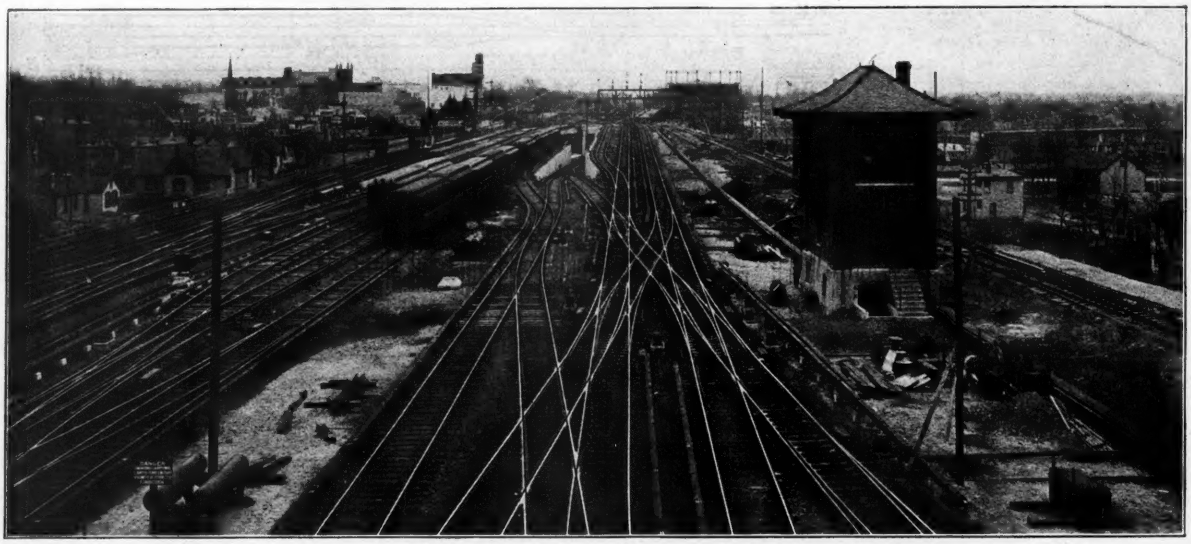


Fig. 2. "JE" Interlocking, Looking East, Jamaica Terminal, Long Island R. R.

The 2,200-volt alternating current delivered at each of the interlocking plants, as already mentioned, is stepped down by static transformers to 220 volts for the operation of lights, track circuits and special a. c. synchronous motors direct connected to special d. c. generators for charging the storage batteries. These batteries consist of duplicate sets of seven cells each, and are of sufficient ampere-hour capacity to supply direct current at from 12 to 14 volts for the operation of all switch and signal controlling magnets, etc., as well as to operate the generators as motors when, for any reason, the 2,200-volt alternating current supply is cut off. The purpose of this emergency operation is to maintain the lights in the signals during a failure of the alternating current supply. To accomplish this each set is made up of a 15-volt d. c. generator and an a. c. synchronous motor. By means of relays operating a set of contactors on the switchboards a failure of the 2,200-volt a. c. supply causes the d. c. generators to be driven as a motor by current from the storage batteries, and the synchronous motor becomes a generator giving 220 volts, 25 cycles a. c. At the time this emergency operation occurs, certain definite field rheostat connections are made so that the reversing of the motor generator does not necessitate any field adjustment whatever.

The control circuits for the contactors are so arranged that this emergency service takes effect only when the signal lighting switches on the switchboard are closed, so that if the a. c. power should go off at a time when the lights are not needed the emergency shifting does not take place. Each interlocking

track connections that run up and across signal bridges, etc., are made of wood in accordance with usual practice.

INTERLOCKING MACHINES.

The interlocking machines are of The Union Switch & Signal Company's standard electro-pneumatic type, with standard equipment for electric detector circuits, which are used in lieu of detector bars throughout the installation. These machines are also equipped with lever lights, as shown in Figures 10, 11 and 12, mounted directly below the levers, so arranged as to indicate to the signalman the condition of the switch or signal controlled by the lever under which the light is placed. Each switch light burns at all times except when the lever under which it appears is locked. The signal lever lights remain out except when the levers are moved from the full normal position and the signals controlled are at stop.

Each interlocking machine is equipped with a track model as shown in the illustrations. The model shows the layout of tracks, signals, etc., governed by the machine, as well as the number of the various switches, signals, check locking levers, etc. Small lamps which illuminate small round discs in various parts of the model are also provided to indicate whether or not the different sections of track are occupied.

The cabinets used to house the relays in the towers are provided with glass doors, as shown in Figure 9, so that the relays may be examined without difficulty. At the back of each cabinet is a space similar to that shown in this illustration, where the wires are distributed throughout the cabinet to the three-

way brass terminals, which provide means of attaching the short connections to the relays and facilitate tests when required.

In all signal installations where a considerable number of the units are controlled it is essential that a comprehensive system of identification be provided for the various wires, cables, relays, etc., in order that workmen may find any particular piece of apparatus or wire in the shortest possible time. For this purpose a complete set of circuit plans for each plant is provided, consisting of a number of small plans which are convenient to handle. Each plan shows a particular part of the circuits, the whole being divided into sections as follows:

Second position control of signals.
Third position control of signals.
Detector circuits.
Route locking.
Approach locking.
Signal lock circuits.
Lever light circuits.
Special circuits.

The instruments and wires shown on these plans are indicated by numbers made up in accordance with a recognized standard used by various railroads and signal companies, and each wire or piece of apparatus throughout the installation is equipped with small fiber tags on which are stenciled numbers corresponding to those shown on the plans. By this means a repairman may in the shortest possible time find any wire or instrument and make such test or examination as may be desired. Terminal boards are provided in the tower relay cabinets, the interlocking machines and in the small relay closets outside of the towers where the use of small brass terminals to which the wires are attached provide means for making tests with the least possible delay.

ELECTRIC LOCKING.

Approach electric locking is provided for all the routes controlling signals governing high speed movements into the interlockings. This insures that the signal lever cannot be returned to the full normal position and the locking of the switch levers in that particular route released while the track section, between the first automatic block signal in the rear of the distant signal and the home signal controlled by the lever in question, is occupied. Eight indicators are provided to show the presence of trains in these sections and thus give the operators information concerning approaching trains. The Union Switch & Signal Company's standard clockwork time releases are provided in connection with this locking. They are so arranged that, should it be necessary to release one of the signal levers, it may be done by manipulating the time released. This operation requires two minutes.

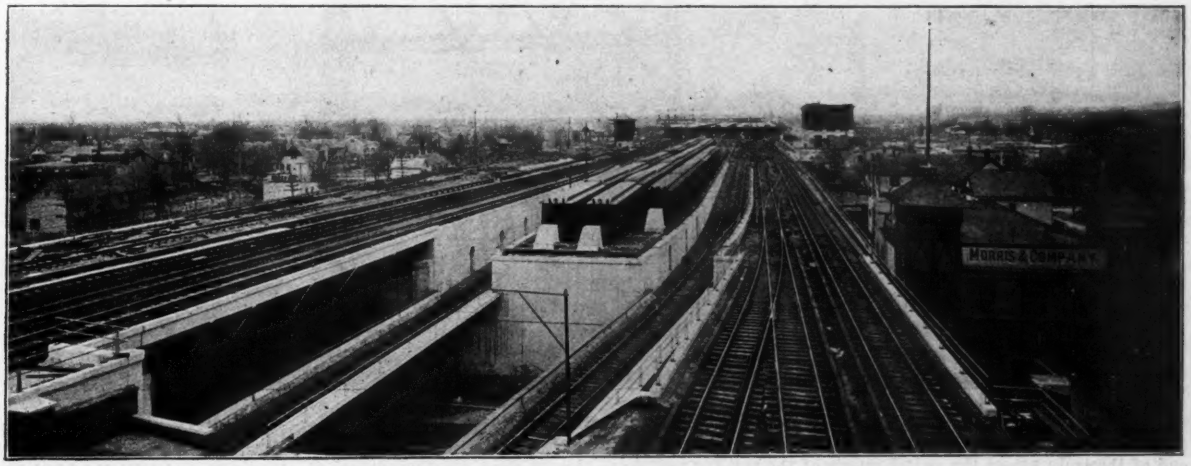


Fig. 3. "JE" Interlocking, Looking West, Jamaica Terminal, Long Island R. R.


Fig. 4. "H" Interlocking, Looking West, Jamaica Terminal, Long Island R. R.

In addition to the standard detector circuits used in lieu of detector bars, route locking is provided which, through the medium of track circuits, locks all levers governing switches in any route as soon as a train passes the signal governing that route. Each switch lever is released as soon as the rear

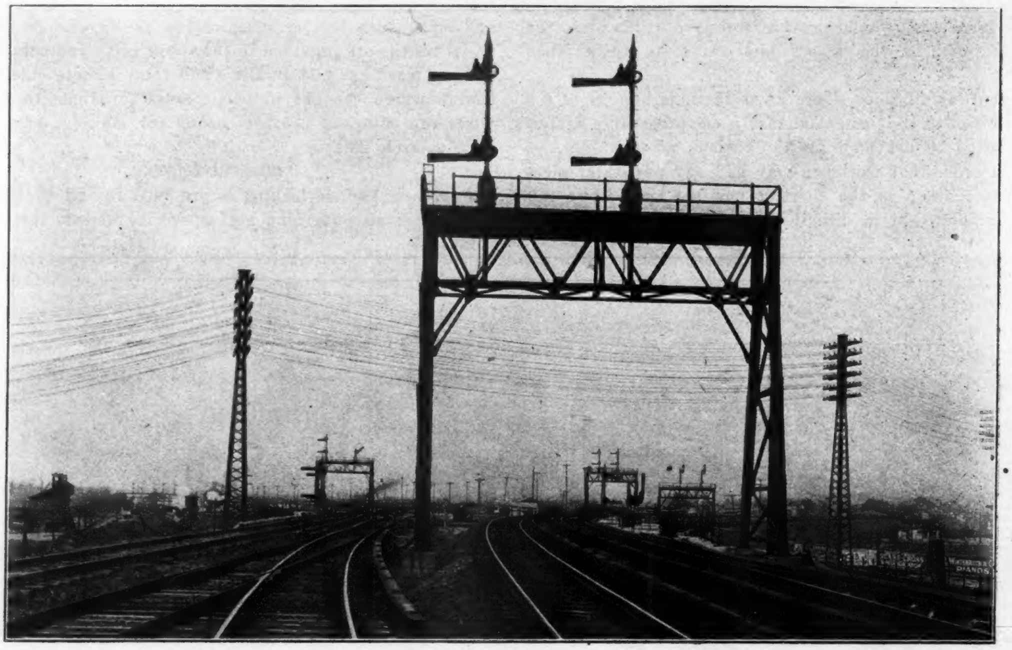


Fig. 5. Jamaica Highline, West of "J" Tower, Looking West.

end of the train passes the switch points of the trailing switches or the fouling points of the facing switches. The release of the switches in the rear of trains in this manner permits the signalman to make the maximum number of movements consistent with safety and prevents the movement of any switch in a route ahead of a train which has passed a signal in the proceed position.

For the protection of train movements between interlocking plants a system of locking between towers is provided. This is so arranged that movements into a given section of track between plants cannot be made from each end simultaneously nor, under any condition, can movements be made into a section of track which is occupied, except by manipulating a clock-work time release. When conditions are right this will permit route or low speed signals to be cleared and allow train movements at reduced speed. This system of locking is accomplished without the use of extra or special levers. The regular levers used for the control of signals to one extreme position are used in the other extreme position for the control of the direction of traffic.

The air connections to all three-position signals are so arranged that compressed air cannot enter the cylinder which operates the signal from 45 deg. to 90 deg. unless the controlling valve which permits air to enter the cylinder operating the signal from 0 deg. to 45 deg. is in the proper position. This feature insures the return of the signal to the stop position when the magnet controlling the 45-deg. position of the signal is de-energized.

Circuits for the control of the various signals are of the usual character, arranged so that the top arms or high-speed signals are used for straight routes only, and the lower or route arms for all diverging routes. The high-speed signals only are semi-automatic, the 0-deg. to 45-deg. position being controlled from the interlocking machine, and the 45-deg. to

Fig. 6. "J" Interlocking, Looking West, Jamaica Terminal, Long Island R. R.

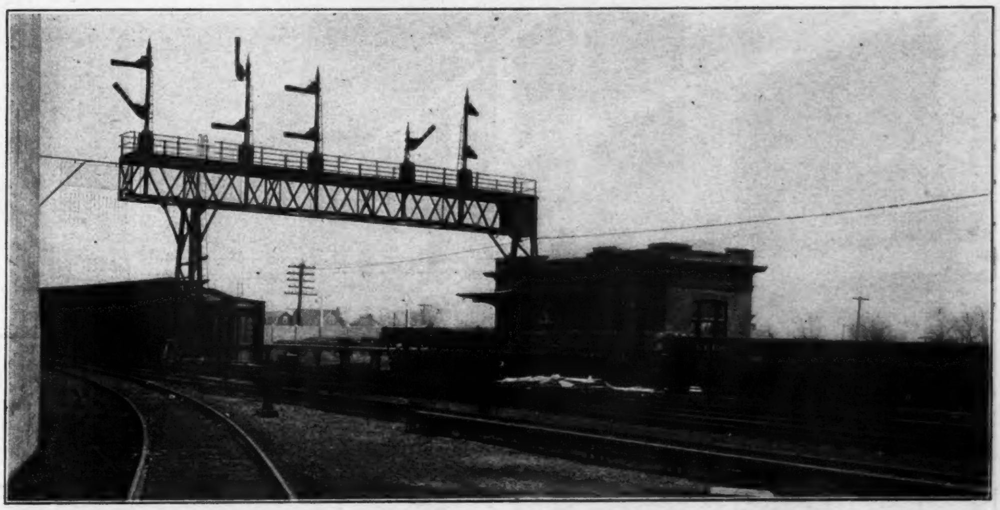


Fig. 7. Jamaica "MP" Interlocking, Long Island R. R.

90-deg. position by the position of the next signal in advance.

A push button is provided in each interlocking machine directly under each high-speed signal lever, so arranged that after the lever is moved to the reverse position the button may be depressed. This will close a contact and cause the route signal to move to the 45-deg. position for a slow-speed movement into an occupied section governed by a high speed signal. This push button is automatically held depressed until the lever is restored to normal position. The dwarf signals are standard Union Switch & Signal Company's two-position electro-pneumatic upper quadrant—Figure 10.

Figure 14 shows a typical relay and transformer installation in the instrument case. It can readily be seen that inspection can be made with the least inconvenience and delay and fuses easily replaced.

TRACK CIRCUITS, TRANSFORMERS, RELAYS AND IMPEDANCE BONDS.

Alternating current derived from the main supply at the interlocking towers, where it is stepped down from 2,200 volts to 220 volts, is distributed throughout the installation for the operation of all track circuits. The majority of these circuits within the interlocking limits are of the single-rail type, in which one rail is given up for the exclusive use of the signaling current, while the other rail is used for both the signaling and return propulsion current. In this territory the propulsion current is 500 volts d. c., derived from a third rail. The signal rail is divided into sections by Keystone insulated rail joints.

The transformers which supply current to the single-rail track circuits are of the air-cooled type, Figure 12, each transformer being arranged to feed a minimum of two track circuits. This track circuit current is carried through a 30-ampere fuse and a variable resistance to the track.

In some of the track sections between the interlocking plants, as well as approaching the terminal, it is necessary that both rails be available for the return propulsion current; therefore, double-rail track circuits were installed. This type requires the use of two insulated rail joints, one in each rail, and an impedance bond connected between the rails at the end of each track circuit.

Current for all double-rail track circuits is derived from the

Fig. 8. Jamaica "J" Machine, Long Island R. R. Interlocking.

Fig. 9. Relay Cabinet, "J" Tower, Jamaica Interlocking, Long Isl and R. R.

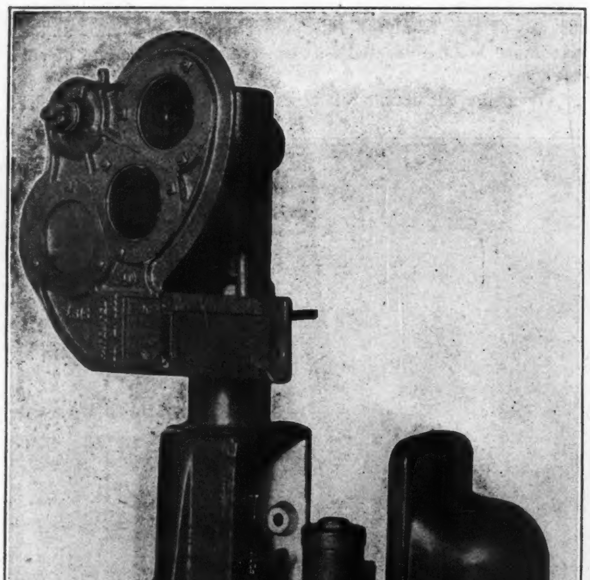


Fig. 10. Electro-Pneumatic Dwarf Signal, Jamaica Interlocking, Long Island R. R.

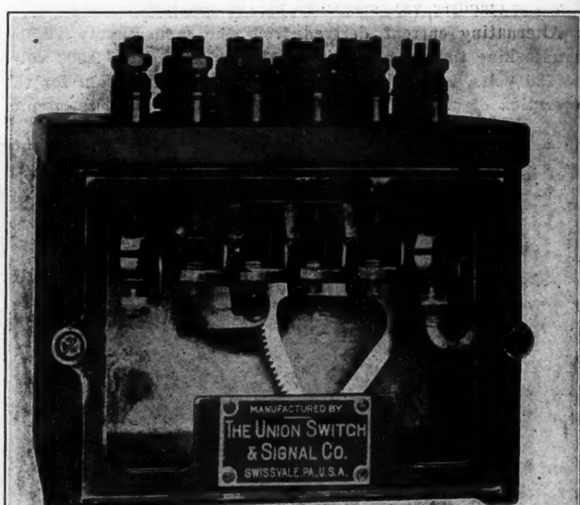


Fig. 11. Model 12 Polyphase Relay, Jamaica Interlocking, Long Island R. R.

220-volt a. c. mains, which extend through the installation. This is stepped down to the proper potential by the same type of transformer used for the single-rail circuits.

The Union Switch & Signal Company's Model 12, polyphase relays of the two-element type, Figure 11, are used for all double-rail circuits over 500 feet long. One element is connected to the track and the other to a 12-volt secondary tap

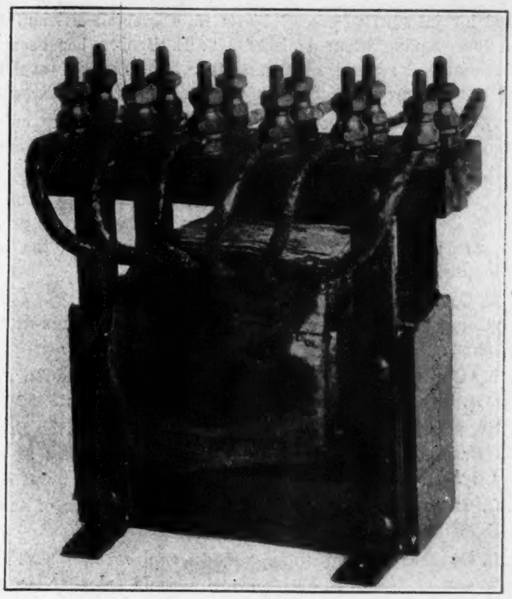


Fig. 12. Track Transformer, Jamaica Interlocking, Long Island R. R.

Fig. 14. Instrument Case, Jamaica Interlocking, Long Island R. R. Darius Miller.

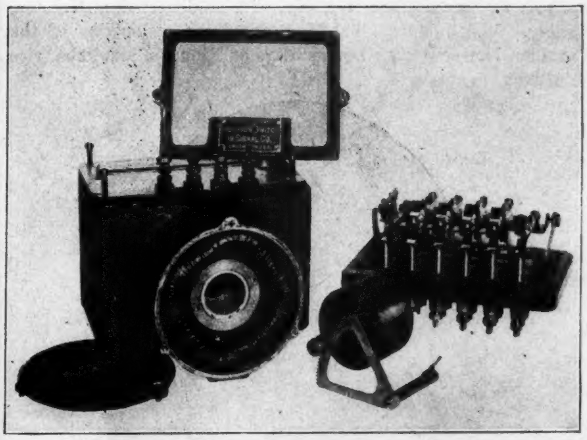


Fig. 13. Parts of Model 12 Polyphase Relay, Jamaica Interlocking, Long Island R. R.

on the nearest transformer. All track transformers are provided with a tap to give this voltage, in addition to the other taps needed to supply the proper potential for the operation of the track circuits, whether of the single or double-rail type.

The bonds consist of a heavy copper strip passing several times around a laminated soft iron core, with a tap at the center of the coil to connect with a like tap on the bond of the adjoining track circuit. This connection provides a path of negligible resistance for carrying the return propulsion current around the insulated joints, while offering an impedance to the alternating current used for the track circuit sufficient to give a difference of a. c. potential across the bond terminals for the operation of the track relay, which is connected to the rails at a point close to where the bond connections are attached.

All the apparatus involved in the four Jamaica terminal plants was installed by the Union Switch & Signal Company, under the supervision of Mr. E. M. Weaver, engineer maintenance of way, and Mr. Charles Soper, supervisor of signals, Long Island R. R. Mr. L. F. Viellard was field inspector for the signal company.

NEW SIGNAL INSTALLATIONS.

The Baltimore & Ohio has placed an order with the Union Switch & Signal Co. for an electric interlocking plant near Chicago at Calumet River draw.

The Illinois Central will install a telephone system of train despatching between Clinton and Centralia, Ill., a distance of 115 miles. Work will be begun immediately, it is said, and the date of completion is set as October 1, 1914.

The Missouri, Kansas & Texas has given the Union Switch & Signal Co. the contract for the installing a mechanical interlocking plant at Whiteright, Tex.

The Nashville, Chattanooga & St. Louis has given the Union Switch & Signal Co. a contract for installing an electro mechanical interlocking plant at Cravens, Tenn.

The Canadian Northern, it is reported, has completed plans for constructing a steel bridge across Fraser river at New Westminster, B. C.

Sciotoville, Ohio, has been chosen as a proper site for bridge over Little Scioto river for the Chesapeake & Ohio, by Government and railway engineers. Bids have been received on both the substructure and superstructure. This road has prepared plnas for lengthening and raising its bridge over the White river at Muncie, Ind.

The Chicago & North Western has awarded a contract for a bridge over the Milwaukee river in Milwaukee, Wis., to the Cleary-White Construction Co.

The Chicago, Burlington & Quincy, it is said, will build an elevator of 250,000 bu. capacity at St. Louis, Mo.

The Chicago, St. Paul, Minneapolis & Omaha has been ordered by State Railroad Commission to build viaduct at Putnam St., Eau Claire, Wis.

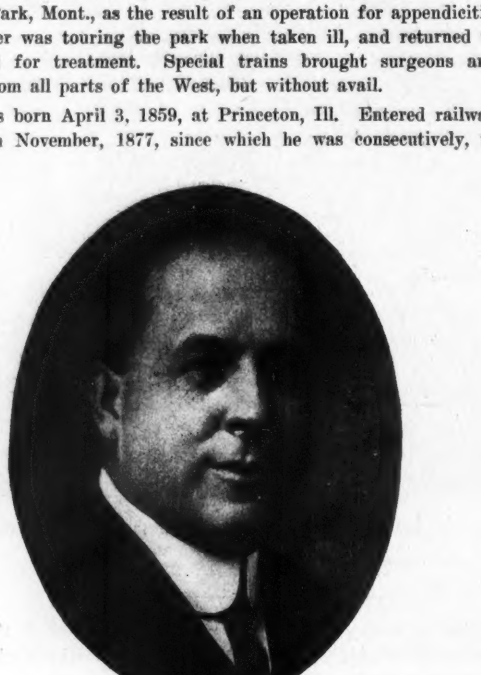
Citizens of St. Catherines, Ont., have voted to issue $150,000 in bonds for construction of high-level bridge across the Welland Canal. To this amount the Grand Trunk Railway Co. will give $20,000 and the Dominion Government will give $50,000, making a total of $220,000.

The Northern Pacific will make repairs to its coal bunkers on the waterfront at Seattle, Wash., at a cost of about $35,000.

Personals

DARIUS MILLER, president of the *Chicago, Burlington & Quincy Railroad*, died at 10:10 a. m. August 23 in the Glacier Park Hotel, Glacier Park, Mont., as the result of an operation for appendicitis. Mr. Miller was touring the park when taken ill, and returned to the hotel for treatment. Special trains brought surgeons and nurses from all parts of the West, but without avail.

He was born April 3, 1859, at Princeton, Ill. Entered railway service in November, 1877, since which he was consecutively, to



Darius Miller.

June, 1880, stenographer in general freight office Michigan Central; June, 1880, to February, 1881, clerk in general freight office St. Louis Iron Mountain & Southern; February, 1881, to October, 1883, chief clerk to general manager Memphis & Little Rock; October 8, 1883, to June 1, 1887, general freight and ticket agent of the same road; June, 1887, to July, 1889, general freight and passenger agent St. Louis, Arkansas & Texas; July 1, 1889, to December 15, 1890, traffic manager same road; December 15, 1890, to May 20, 1893, traffic manager Queen & Crescent Route; May 20, 1893, to September 1, 1896, traffic manager Missouri, Kansas & Texas; September 1, 1896, to November 15, 1898, vice-president same road; November, 1898, to December 31, 1901, second vice-president Great Northern; January 1, 1902, to January 31, 1910, first vice-president Chicago, Burlington & Quincy, and from that day to the day of his death, president Chicago, Burlington & Quincy. Darius Miller had an acute sense of the rights of the public and was filled with a spirit of reasonable concession. He was a railway head of the type that recognizes a railway's obligation of public service as fully as its opportunities for profit. His death is a loss to his friends, his profession and the general public.

E. T. LAMB, receiver and general manager of the *Atlanta, Birmingham & Atlantic Railroad*, with headquarters at Atlanta, Ga., has been elected president of its sucessor the *Atlanta & Birmingham Ry.* BROOKS MORGAN, of Atlanta, has been elected vice-president, and F. K. MAYS, treasurer and purchasing agent, has been appointed secretary and treasurer.

J. L. TERRY, general superintendent and auditor of the *Denver, Laramie & Northwestern*, has been appointed general manager, with headquarters at Denver, Colo.

PAUL A. G. TILMOT has been appointed assistant roadmaster of the *Northern Pacific* at Tacoma, Wash.

CHARLES W. COE, superintendent of the Toledo division of the *Wheeling & Lake Erie railroad*, with headquarters at Brewster, O., has had his jurisdiction extended over the Cleveland division, divisional lines having been abolished. F. E. BARBER has been appointed assistant superintendent and D. J. NORRIS assistant superintendent of transportation, both with headquarters at Brewster.

F. D. NAUMAN has been appointed division engineer on the Chicago division of the *Baltimore & Ohio*, with headquarters at Garrett, Ind., succeeding John Tordella, promoted.

On August 15 ROGER TIMBERLAKE TAYLOR, roadmaster of the Fargo division of the *Northern Pacific*, with headquarters at Dilworth, was transferred to the position of trainmaster, the Lake Superior division, with headquarters at Duluth.

H. M. COULHEART has been appointed roadmaster of the *Chicago, Milwaukee & St. Paul*, vice O. MILLER, with headquarters at Missoula, Mont.

H. M. GRIMES has been appointed roadmaster of the *St. Paul*, vice S. H. SHEAHAN, with headquarters at Saltese, Mont.

R. HUBER has been appointed general roadmaster of the *Denver & Rio Grande*, vice M. J. NELLIGAN, with headquarters at Salt Lake City.

H. J. SIMMONS has been appointed general manager of the *El Paso & Southwestern*, with headquarters at El Paso, Texas.

F. L. GUY has been appointed resident engineer of the *El Paso & Southwestern*, vice J. R. EMERSON, with headquarters at Douglas, Arizona.

R. A. BALDWIN has been appointed engineer maintenance of way of East Grand division of the *Canadian Northern*, with headquarters at Toronto, Ontario. J. D. EVANS has been appointed division engineer of the Canadian Northern, with headquarters at Trenton, Quebec. W. B. MORRIS has been appointed roadmaster of the Canadian Northern, with headquarters at Brandon, Manitoba, vice J. HENRY.

M. J. Conran, President St. Louis & Missouri Southern.

M. J. CONRAN has been elected president of the *St. Louis & Missouri Southern Railway*, in place of E. S. McCarty, and W. W. HYDE has been appointed superintendent, succeeding D. J. McCarty, both with headquarters at New Madrid, Mo.

F. D. NAUMAN has been appointed division engineer of the *Baltimore & Ohio Railroad* at Garrett, Ind., in charge of the Chicago division. He succeeds John Tordella, who was promoted recently.

E. C. DEAL has been appointed vice-president and chief engineer of the *Carolina and Yadkin River Railway*, with headquarters at Greensboro, N. C., vice J. P. Clark resigned.

L. A. O'NEAL has been appointed roadmaster of the *Changuinola Railway*, vice C. F. NICHOLS, with headquarters at Bocas del Toro, Panama.

P. W. MILLER has been appointed roadmaster of the *Charleston and Western Carolina*, vice J. D. DEAN, with headquarters at McCormick, S. C.

J. L. HAYES has been appointed division engineer of the *Rock Island*, vice W. L. HOPE, with headquarters at Rock Island, Ill.

L. C. BRITTON has been appointed general manager of the *Alabama Central.*

T. A. MOORE has been appointed roadmaster of the *Santa Fe*, with headquarters at Williams, Arizona.

W. H. RIFE has been appointed acting signal supervisor of the *Santa Fe*, with headquarters at La Juna, Colo.

W. E. PITTS has been appointed supervisor of track of the *Atlanta & West Point*, with headquarters at West Point, Ga.

T. L. CANNON has been appointed supervisor of signals of the *Baltimore & Ohio*, with headquarters at Milan, Ind.

G. M. POLEY has been appointed architect of the *Atlantic Coast Line*, with headquarters at Wilmington, N. C.

G. S. HARDEN has been appointed superintendent timber preserving plant of the *Buffalo, Rochester and Pittsburgh*, in addition to his position of roadmaster, with headquarters at Bradford, Pa.

D. W. GROSS, chairman of the valuation committee of the *Atlantic Coast Line*, has been appointed valuation engineer and relieved of all duties as engineer of construction, with headquarters at Wilmington, N. C.

HALE HOLDEN, vice-president of the *Chicago, Burlington & Quincy*, has been elected president, with office at Chicago, succeeding Darius Miller, deceased.

THORNWELL FAY, former president of the *Sunset Central Lines of the Southern Pacific Co.*, has been appointed assistant to the receivers of the International & Great Northern Railway. A. G. WHITTINGTON has been appointed general manager.

T. E. WHITE has been appointed supervisor of track, District No. 1, of the *Louisiana & Arkansas Railway*, with headquarters at Minden, La., succeeding J. T. Cherry, resigned.

Brooks Morgan, Vice President Atlanta & Birmingham Ry.

BROOKS MORGAN has been elected vice-president of the *Atlanta & Birmingham*, the reorganized Atlanta, Birmingham & Atlantic, with headquarters in Atlanta. He started his railway service in 1892 as agent's clerk of the Cincinnati, New Orleans and Texas Pacific, at Lexington, Ky.; 1894-1896, chief clerk assistant general passenger agent Southern Railway, Louisville, Ky.; 1895-1897, chief clerk to chief assistant general passenger agent Southern Railway, Atlanta, Ga.; 1897-1900, division passenger agent Southern Railway, Atlanta, Ga.; 1901-1905, assistant general passenger agent Southern Railway, Washington, D. C.; 1905-1907, chief assistant general passenger agent Southern Railway, Atlanta; 1907, to the time of his appointment to the vice-presidency of the Atlanta & Birmingham, vice-president and general manager of the Frank E. Block company of Atlanta.

With The Manufacturers

INDUSTRIAL NOTES.

THE C & C ELECTRIC & MFG. CO., of Garwood, N. J., has removed its Detroit office from 144 Seyburn Ave. to 1111 Chamber of Commerce Bldg. This office is in charge of R. K. Slaymaker.

THE CHICAGO CAR HEATING COMPANY, CHICAGO, has removed its southern office from 521 Realty Trust building, Atlanta, Ga., to 829 Munsey building, Washington, D. C.

THE TRANSPORTATION UTILITIES CO. of New York has opened a branch office at 1201 Virginia Railway & Power Bldg., Richmond, Va. This office will be in charge of Frank N. Grigg.

The Metals Coating Company has been incorporated with offices in the Peoples Gas Bldg., Chicago, to operate in this country under the Schoop patents, covering a process of coating objects of whatever nature and material with a great variety of metallic substances. This process, which was originated by an inventor of Zurich, Switzerland, consists essentially in atomizing the coating metal in its molten state and spraying it over the surface to be coated.

The Pressed Steel Car Company has completed excavations and concrete work has been started on its new paint shop in McKees Rocks, Pa. The company also has started excavating for a new passenger car shop and store room, 60 by 100 ft., to cost about $15,000.

To handle their increasing business in the northwest territory, the C. & C. ELECTRIC & MFG. CO., of Garwood, N. J., manufacturers of electric motors, generators and electric arc welding equipments, announces the opening of a branch sales office in the Security building, Minneapolis, Minn. This branch will be in charge of R. L. Wells.

THE CEMENT PRODUCTS EXHIBITION CO., 208 South La Salle street, Chicago, has issued notice of the eighth Chicago Cement Show, to be held in the Coliseum, Feb. 10-17, 1915.

The Pennsylvania Equipment Company, Philadelphia, Pa., has moved its office from the West End Trust building to 503 Coleman building.

The Prime Mfg. Company, Milwaukee, Wis., has been organized to manufacture and market railroad supplies. The company is capitalized at $2,500, with A. W. Prime and H. G. Wild as incorporators.

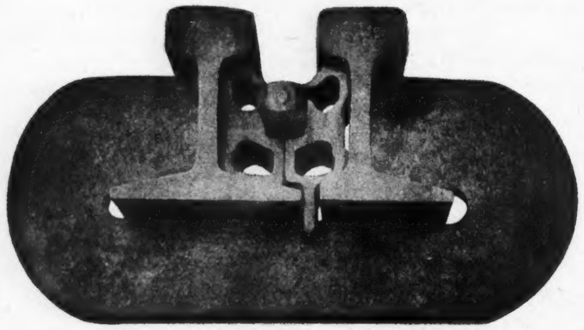
The Seattle office of the American Hoist & Derrick Co. has been moved from 613 Western avenue to 1512 L. C. Smith building. The L. C. Smith building is one of the highest and best equipped office buildings in the country, and its centrel location will be more convenient for out-of-town customers.

INSPECTION OF EYMON CROSSING.

A party consisting of Arthur Crable, division engineer, and C. H. Ward, supervisor, of the Hocking Valley; G. H. Smith, division engineer, and H. M. Fox, supervisor, of the Toledo & Ohio Central; Joseph Mullen, division engineer, and J. M. Cotter, supervisor, of the Big Four, and E. E. Maney, supervisor of the Baltimore & Ohio, were at Carrothers, Ohio, September 1, inspecting the Eymon continuous crossing in service since May 25 on the main tracks of the Pennsylvania lines at that place. This crossing has attracted a great deal of attention on account of the fact that it has given service beyond the expectation of many of its endorsers. There has been no maintenance cost since installation, while it has withstood some very rough treatment. It was fully described in the July issue of *Railway Engineering.*

NEW GUARD RAIL CONNECTOR.

The Heller Forge Works, of East St. Louis, Ill., have gotten out a new guard rail connector that seems to embody simplicity, strength and durability. The connector is made of forged steel and fits snugly against the ball, web and base, of both the runing rail and the guard rail. It is so designed that the turning over of the guard rail is practically made impossible. The rigidity of the connector affords the frog excellent protection on account of the guard rail being held in perfect alignment with the running rail and the point of frog.



Drop Forged Steel Guard Rail Holder.

A filler block is inserted between the rails (as shown in the figure). This is held in place by a wedge-shaped key, which is in turn held in position by a nut and nut lock. The filler block itself is held firmly in place by a lug which straddles the yoke proper. It is apparent that there is no strain on the key as is the case in the bolts of the old type holders.

TIMBER PRESERVATION.

From the beginning of the practice of injecting chemicals into wood to prevent decay, wood preserving engineers have known the benefit to be expected from the use of creosote and zinc chloride together. Thirty years ago the late Joseph P. Card treated timber with creosote and zinc chloride solution by first injecting a small amount of creosote and following with an injection of zinc chloride solution.

The benefit gained by the double treatment was considered of enough value to more than offset the expense of giving two treatments to the timber.

The Allardyce process also required two separate treatments of the wood, zinc chloride being injected first, followed by a treatment with creosote. This method never won the favor of practical wood preservers, owing to the fact that after the wood was filled with zinc chloride solution, little or no creosote could be forced in.

In 1906, Joseph B. Card patented a closed circuit apparatus for emulsifying mixtures of preservatives, thus making possible the injection of zinc chloride and creosote at one operation. This method was a long step in advance and, regardless of its imperfections, has been well received.

In 1914 William A. Cecil perfected the Cecil-Williams method of emulsionizing mixtures of preservatives in the operating tank and maintaining the emulsion in a homogeneous condition by circulating the mixture through the impregnating cylinder and back again to the operating tank during time of, and without any loss of, pressure in the cylinder.

The new process is a method of circulating preservative fluids from the operating tank through the retort and back to the operating tank, while raising and maintaining pressure in the retort.

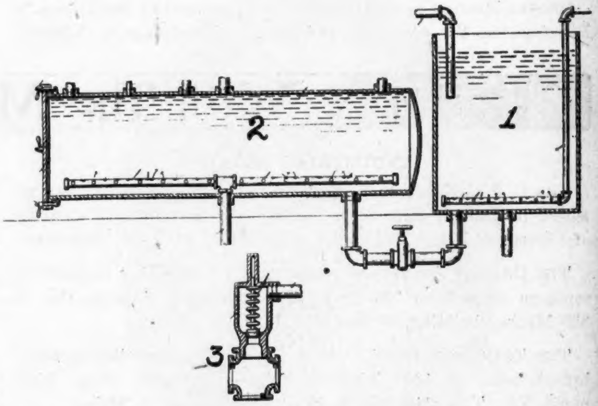
The inventors claim that their open circuit circulating apparatus maintains a perfect emulsion of zinc chloride solution and creosote. The advantage they claim over other methods of circulating preservatives is the elimination of air that is always retained in the retort after filling, and that driven from the wood and aerated emulsion as the liquid penetrates.

The free air has a tendency to break down the mixture and make it foam in the retort when it has no outlet. By the new method all the free air passes out of the retort as soon as it is freed and the mixture or emulsion remains of equal density at all times.

The Indiana Tie Company proposes to use the Cecil-Williams method of circulating the fluid preservative at all times regardless of the nature of the preservative used.

Heretofore there has been no circulation of fluids in retort except when treating with mixtures of preservatives of different specific gravities, but they claim that dead pressures are not conducive of the best work. When the preservative is constantly circulated while under pressure in the retort, the suspended matter in the liquid is carried along by the flow of the liquid, thus the pores and cells are not plugged so as to prevent the entrance of the fluid, and a more uniform penetration is accomplished, especially of the dense and close-grained woods, than is possible in a dead pressure, and the wood comes from the retort cleaner, after being subjected to a washing action of the liquid while under pressure.

The illustration shows a cross section of the special machinery required for this process. The operating tank 1, which is designed to contain the supply of liquid that is being constantly circulated through the impregnating cylinder 2, during the operation of treating timbers therein, has a suitable agitator located therein to keep the supply liquid constantly agitated and mixed to a homogeneous solution. This agitator may be of any desired form but in the present instance is illustrated



Cross Section Cecil Williams' Wood Preserving Plant and Special Valve.

as an air-supply pipe 3 which is run to the bottom of the operating tank 1 and is extended along the bottom where it is provided with the perforation 4 which permits the air supplied thereto to pass up through the liquid and disturb the ingredients of the heaviest specific gravity which will have settled to the bottom of this tank and to cause these ingredients to be moved in an upward current through the ingredients of lighter specific gravity which have a tendency to rise to the top of the solution, thus the entire solution is being constantly agitated and the desired homogeneity is maintained. Figure 3 is an enlarged detail sectional view to better illustrate the detail structure of the automatic pressure valve.

This method has been worked out and patent applied for by William A. Cecil, wood preserving engineer, and Robert R. Williams, vice president of the Indiana Tie Company of Evansville, Ind., and is the method that is being used universally by them in timber treating.